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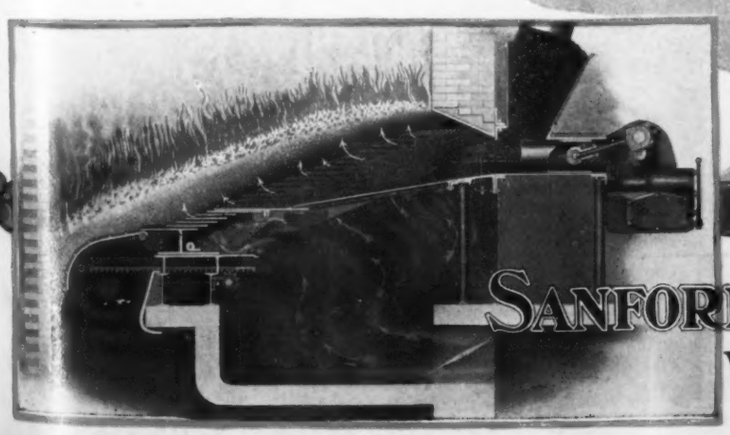

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Buying Other Persons' Coal for Them

IN PETITIONING the City Commission for an increase in rates, the Sandusky (Ohio) Gas & Electric Company points to the many industries that have discontinued their own steam plants because of the high price of coal and are now purchasing power from the central station, which has to pay the same high price for fuel while continuing to sell electricity at before-the-war rates. These firms, the company says, "have taken advantage of our predicament to such an extent that anything like good service is impossible." An enforced contribution to the coal piles of independent plants would not be so vastly different in principle.

Investing for Service

THE temptation to continue in a rut so long as affairs run smoothly needs to be guarded against by users of industrial power and illumination no less than by individuals in personal matters. It is easier to let a motor installation function with routine cleaning and lubrication than to check its fitness for service under possible changes in conditions. To assume that so long as no complaints arise a lighting equipment need not be photometered or otherwise tested is to follow the path of least resistance. While periodical tests are coming more and more into vogue in large manufacturing plants, countless factories of more than average size have still to be awakened to the fact that their maximum efficiency is in the hands of men who should be encouraged to cultivate engineering methods of analysis in addition to "trouble shooting." Few worse errors in management can be made than to oppose reasonable investments in betterment work because of inertia and narrow vision.

A Notable Centennial

JUST a year ago, in a special supplement accompanying our issue of June 21 and bearing the title "A Glance at Early Electrical Literature," the ELECTRICAL WORLD suggested that July 21, 1920, the centenary of the publication of Hans Christian Oersted's epoch-making Latin treatise, "Experiments on the Effect of a Current of Electricity on the Magnetic Needle," would be a fitting date for commemoration by the electrotechnical profession. We print this week a letter from Dr. Francis B. Crocker in which he makes a similar suggestion. Very properly Dr. Crocker couples with the name of Oersted, as did the ELECTRICAL WORLD, the name of André Marie Ampère, the great Frenchman to whom was due the immediate development of the discovery made, perhaps somewhat fortuitously, by the Danish scientist. The relative degree of credit which is the due of each man and of the other early electrotechnicians who followed the paths thus opened up must be left to the historians of the art to apportion, but the centennial should not pass unobserved. It is our hope that the A. I. E. E. will call together American scientists in order that they may contribute for permanent record reflections from their experience and study which bear upon the influence of the early work of Oersted and Ampère in the United States and the great development of technical literature from its small beginnings.

Publicity for the Engineer

AS WE have already said, the Federated American Engineering Societies are to be congratulated on their recognition of the principle of publicity. There is very high authority against hiding one's light under a bushel. Modesty may compel an individual to do this, and his diffidence may be accounted a virtue. But diffidence in an organization is akin to cowardice and works to defeat the ends of the body that harbors it. When the engineering world shall speak out habitually and authoritatively, through the professional and the lay press alike, to recount its achievements, to outline its projects and to tender its advice on all matters where it has knowledge and a collective concern, it will both perform an imperative duty and help individual engineers to gain the greater degree of recognition, the higher scale of remuneration and the broader sphere of influence that should be theirs. The Federated American Engineering Societies have taken a forward step in this direction and established a precedent on which all engineering societies can effectively lean.

Central Stations Can Aid in Fire Prevention

CARELESS handling of electric flatirons, a prolific cause of local electrical fires, and the carelessness of maintenance men who are allowed to do wiring in large blocks and buildings because they have maintenance licenses are conditions recently deplored by Chief John F. Healy and Electrical Superintendent David Reed of the Denver (Col.) fire department. The necessity of keeping live wires free from contact with gutters, fire escapes and other carriers and the dangers brought about by the addition of loads without providing additional carrying capacity in the building wiring were also emphasized. Chief Healy declared that the men of the electrical industry in particular can help to remove these hazards. Although not one fire in ten in Denver charged against electrical causes is actually due to such a cause, the statements of these officials merit the careful attention of electrical central-station men. Fires do not occur, they are caused, and all too many are caused by the forms of carelessness to which attention has just been called in Denver. Every fire due to preventable electric causes, and particularly those within the homes, where the use of electrical appliances is so rapidly increasing, may be justly regarded as a black mark against central-station service in every case where indifference is displayed in regard to the degree

of safety that this service can justly claim. Electrical wiring can be done in such a way and appliances are so manufactured that fire hazards from electrical causes should be almost nil. Carelessness and ignorance make them much larger than they should be, and the educational campaign necessary to eliminate such carelessness and ignorance is a very important part of the central station's service to its customers. Every central station might profitably include in its commercial policy a definite campaign of education on the elimination of electrical fire hazards and a positive campaign of education on the proper use of electrical appliances. That the public at large has an exaggerated idea of these hazards is evidenced by the tendency to attribute all fires of unknown causes to electricity. A persistent campaign of education is the most effective remedy.

Recent Practice in French Hydro Plants

THE activity of our French friends in hydro-electric work has been of late years very marked, and even under the terrible stress of war it has gone on in a way that is most encouraging from the standpoint of general electrification. Two very recent developments furnish power to the electrified section of the Midi railway across the Pyrenees between France and Spain and are considered in this issue by M. Pahin. More than 500 miles (800 km.) of railway is involved in this big undertaking, and the needs of war and the shortage of coal combine to make hydro-electric development imperative. Two large plants at Soulom and Eget respectively were pushed into utilization. The former is peculiarly interesting because it derives its water supply from two neighboring rivers under two different heads. From one of the streams, the Cauterets, water is taken in a deep gorge and passed through settling chambers and screens until it enters a cement-coated underground canal for a distance of about 2 miles (3.2 km.), where it finally widens into a subterranean reservoir flowing into an open reservoir which leads to a compression chamber and the penstocks. The storage capacity in these reservoirs is good for about four and half hours' flow of the entire stream, and the penstocks from it feed three independent groups, each consisting of a 3,500-hp. Pelton-type two-nozzle wheel driving a 2,400-kw., 6,000-volt, 500-r.p.m., single-phase alternator. An interesting point about this plant is that the penstocks do not have any permanent expansion joints or any similar contrivances. They are welded in 60-ft. (18-m.) sections assembled with flanged and bolted joints on a total length of more than 1,700 ft. (518 m.). The penstocks are so firmly anchored that expansion is restrained just as in the case of a continuous electrically welded rail. Each penstock is equipped with a flow meter, and the net head utilized is 820 ft. (249 m.)

The second stream which supplies the system is the Gavarnie, of somewhat larger flow but much lower head. The water is taken into a forebay formed by a dam, passes racks and settling chambers, then into the head canal, which is 4 miles (6.4 km.) long, terminating in a compression chamber. The penstocks, arranged something like those on the Cauterets, are about 1,000 ft. (300 m.) long. Each drives a unit similar to those already described, the six units from the two sources being brought into the same machine room. The water from the Gavarnie fall is utilized in Francis radial type turbines at a net head of 372 ft. (113 m.). In case of shutdown of one of the Cauterets units extra water can be diverted by a cross penstock to the compression chamber of the Gavarnie fall. The transmission is at 60,000 volts. The plant is unique on account of the duplex source of power on two different streams.

The second development, at Eget, derives its power from the Neste, which feeds various storage reservoirs for steadying the flow on the headwaters of neighboring streams. A special storage lake is provided for the plant. The net head in this case is 2,330 ft. (710 m.), and the equipment is of typical high-head form. The seven main units are driven by 5,000-hp. wheels, and there are two auxiliary units for exciters. The general conditions of the installations here are much the same as in the previous plant. In this installation it was found desirable to provide slip joints for the penstocks during the period of construction, when the expansion is greater than if the pipes are full. Later, and at an average temperature, the anchorages were made solid. Three other plants form the complete equipment of the electrification and are to be rapidly brought into service.

Modernizing Two-Phase Distribution

IT IS curious to look back and realize how the growth of electrical service, especially through the employment of motors, has modified all the earlier notions as to systems of distribution. In the beginning of power transmission by alternating current the service rendered was chiefly for lighting, the motor loads being small and rather incidental. In the few cases where heavy motor service was required recourse was generally had to operation at 25 cycles. Looking back over the development of five-and-twenty years, the early general distrust of polyphase motors seems a curious phenomenon, particularly since they were so swiftly and successfully developed—without any material difficulty in fact, whatever trouble may have been expected. The result of the predominance of the lighting load was the frequent use of the otherwise undesirable two-phase distribution, the introduction of the now defunct monocyclic system, and earnest and useful efforts at the production of single-phase motors in spite of the inherent difficulties. Today there still linger a very few two-phase systems, for the most part dating back a quarter of a century; but one after another these relics of earlier practice when motors were few are being changed over to the standard forms of three-phase distribution.

In this issue G. H. Hagar gives an interesting account of a change from two-phase to three-phase accomplished in the system of the Vallejo Electric Light & Power Company. Oddly enough, for a good many years this company has bought three-phase power from the Pacific Gas & Electric Company and transformed it by the Scott system to two-phase. The whole system, substation and all, was gradually outgrown, and it was decided to change from the old distribution to a three-phase, four-wire system of 4,000 volts between the phase wires. The great economy of this arrangement in copper is familiar, and in this case it was especially desirable on account of the increased loads. The general problem of shifting from two-phase to three-phase was, of course, a very simple one, the old arrangement being in the form of four-wire circuits. Some useful modifications, however, were made to simplify the motor service. To make the change of customer's trans-

formers the easier the neutral was set up with white insulators, so as to escape all danger of connecting the old transformers across the phase wires. The transformer bank at the substation was replaced by a new one with one spare unit connected delta-delta. For temporary service a booster transformer in quadrature from the midway point of one delta leg enabled both two-phase and three-phase to be conveniently obtained for the time being. In the final arrangement it became necessary to make provision in some way for the use of the considerable number of motors already installed. To this end two radically different methods were adopted. In some cases the installation was made by grouping one standard transformer with two having a nine-to-one ratio, a certain number of these latter units being already on hand and thus utilized in the new arrangement. In the remaining motor installations the motors themselves were reconnected for three-phase, using three standard transformers. On the day finally set for the change-over the secondaries on the substation transformers were changed from delta to star and the booster was disconnected, while the three-phase transformer banks on the system were changed from delta to star and the extemporized two-phase banks likewise cut in. The whole change-over was accomplished in seven hours and with results of an extremely satisfactory character.

Welding Substituted for Rivets in Erection of Structural Steel

THE field of electrical welding has been steadily expanding during the last few years, and the process has already shown great usefulness from the structural standpoint, as, for example, in shipbuilding work, to which it was freely applied during the war. A new and rather notable application is reported by H. P. Payne—the application of electric welding to the ordinary structural steel work in buildings. The plan was tried out in framing a small building and the results proved so promising as to give great encouragement for a wide expansion of the field of electric welding. The structure concerned was a roofed-in shed about 40 ft. x 60 ft. (12 m. x 18 m.), and the net result was to show a very considerable saving over the ordinary riveting process. No holes are required in the steel members; consequently the cross-section may be correspondingly reduced and still retain the same factors of safety. No holes have to be laid out, so the fabrication of the structure resolves itself into cutting the beams and girders into the proper length, putting them into position, tacking them in place, and then finishing the welding in the ordinary way. The operations of setting and alignment are of course the same as with the usual method of construction.

Since there were no data on the strength of welded structural steel members, two trusses were set up and loaded to about double the requirement of the building code, and careful records were kept of the deflection at the start and after forty-eight hours at maximum load. The only permanent set observed was $\frac{1}{16}$ in. (1.6 mm.). From the results obtained it appears that there is an admirable opportunity here for extending the usefulness of electric welding. There seems to be no difficulty whatever in doing the work or inspecting it afterward, and the advantages over ordinary riveting with its necessary expenditure of labor are of a very marked description.

Reactive Power and Unbalanced Circuits

THE term "reactive power," in relation to the power factor of three-phase circuits, is discussed in this number of the ELECTRICAL WORLD by Prof. W. V. Lyon. The material presented is condensed, and a number of propositions are contained in the article all of which merit consideration. In the first place, it is pointed out that in a simple single-phase circuit it is possible for the resistance to vary cyclically, as, for instance, in an alternating-current arc. In such a case the volt-amperes may differ from the active power, even although there is no reactance and no reactive power. Again, if the circuit contains variable reactance—*i.e.*, hysteretic-cored coils—there will be reactive power; but the sum of squares of the active and reactive powers do not in general agree with the square of the volt-amperes. It will be generally admitted that the expressed conclusion is correct; that is, that the use of reactive power in alternating-current calculations will produce nothing but approximate results, except when the current and voltage are sinusoidal and the circuit constants do not vary cyclically. Nevertheless, there are many who consider that in practice the approximate results obtained by the use and measurement of reactive power are satisfactory. The average single-phase circuit deviates considerably from the sinusoidal in wave form, and yet for many practical purposes it is useful to regard it as though the wave form were sinusoidal.

The article suggests that an advantageous definition of an alternating-current power factor would be the ratio of the total actual active power in a circuit or system to the greatest active power that could under the most favorable conditions be obtained from the voltages and currents of the system. When this definition is extended from a simple single-phase circuit to an unbalanced three-phase system, an ingenious geometrical construction is offered for determining the maximum active power that a given set of unbalanced three-phase voltages and currents could produce.

It is further pointed out that the troubles experienced by operating engineers of three-phase systems are often more largely due to unbalanced loads than to a low power factor. A customer who applies a large single-phase load to one side of a three-phase system may give as much trouble to the central station as a customer who applies a large underloaded induction motor of low power factor to all three phases. Indeed, a plea is made for the owner of an induction motor that does not seem to have been offered before. Usually the induction-motor owner has no friends. It is shown that if a bad unbalance is effected by a large local single-phase load, so that the three-phase supply system becomes distorted thereby, an induction motor, operating on the unbalanced system, suffers in its efficiency and output. It is unable to deliver as much power or to give as good an efficiency as it could if the system were balanced. Moreover, the effect of connecting the induction motor to the system is to diminish the unbalance to some extent, or to restore the balance in part. Consequently, although the induction motor may tend to lower the power factor of the system, and so make the system worse than before, yet, by its reaction adversely to the unbalanced components, it may improve the balance and do the system some good, thus proving less an enemy to good order in a three-phase system than has hitherto been thought.

Joseph B. McCall

An organizer and executive widely recognized in central-station development work as a conservative thinker and originator of policies that build good will

FOR twenty-five years Joseph B. McCall has directed the electric public utility affairs of the city of Philadelphia. The huge generating stations which serve that city as well as the needs of the electrified sections of the Pennsylvania Railroad stand as ample testimony to his ability as an executive and his broad vision of the electrical future of the Quaker City. Mr. McCall entered the public utility field in 1886, at the age of sixteen as an employee of the Penn Globe Gas Light Company and, gaining rapid promotion, was in a few years chosen its secretary. In recognition of his able work as one of the organizers of the Penn Heat, Light & Power Company, in 1895, he was elected secretary and treasurer. When that company was absorbed by the Penn Manufacturing Light & Power Company, in 1898, Mr. McCall was chosen as its president, and later, when the Philadelphia Electric Company took over the Penn company, he was continued as president of the consolidated organization. That position he holds today. Although Mr. McCall is among the younger of the chief executives of the great metropolitan public utilities of this country, he is generally regarded as among the veterans in central-station development work and has initiated much new work in station design and service included in the problems associated with the installation of large steam turbines, the handling of large industrial loads and the fluctuating demands of electrified steam railroads.

A self-made man, Mr. McCall exhibits none of that indifference to the welfare of his subordinates that is sometimes attributed to men who have themselves climbed from the foot of the ladder. The physical and mental well-being of the Philadelphia Electric Company's employees has always been among his chief concerns, and their beneficial association has, with the company's backing, taken a leading position among similar associations of public utility employees.

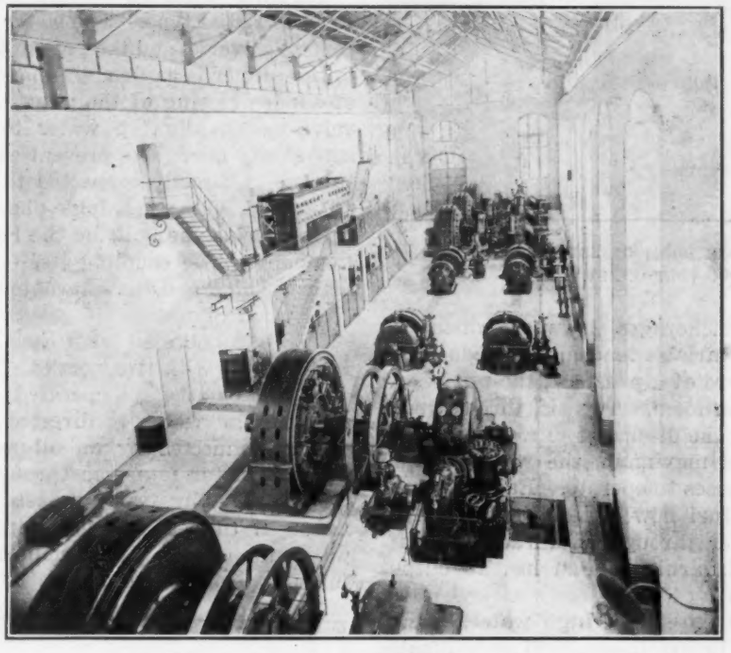
From 1904 to 1907 Mr. McCall served as president of the Association of Edison Illuminating Companies. In 1912 he was elected vice-president of the National Electric Light Association, and in 1913 its president. He is a member of the Franklin Institute and of the American Institute of Electrical Engineers as well as of several local clubs. Mr. McCall was born in New York City, May 12, 1870, but has lived since early childhood in the city of Philadelphia.

Hydro-Electric Plants of French System

Five Power Stations Will Be Ultimately Developed—Soulom Station, Supplying 15,000 Kw., and Eget Station, Supplying 26,000 Kw., Were Rushed to Completion for War Purposes—Heads Vary from 380 Ft. to 2,410 Ft.

By LUCIEN A. H. PAHIN
Pontoise, France

POWER requirements of the electrified section of the Midi Railway across the Pyrenees Mountains between France and Spain are taken care of by two main power stations at Soulom and Eget. Both are water-power developments. The Soulom plant is situated in the narrow valley of the Pau at the junction of the Gavarnie and the Cauterets valley and the Eget plant in the upper valley of the Neste d'Aure. While the electrification work was hampered by the war, the construction of the Soulom and Eget plants was rushed so that they might be used in helping to take care of the industrial load. The growing seriousness of the coal shortage had also made these developments imperative. The railway work involves some 530 miles (853 km.) of route and is in magnitude one of the most important in Europe.



MACHINE ROOM OF SOULOM PLANT

This plant consists of two independent water-power developments. In the background may be seen the three Francis turbines operated from the Gavarnie fall under a head of 380 ft. The group of Pelton turbines in the foreground are operated under a head of 840 ft. from the Cauterets fall.

The Cauterets River has an output varying from 71 sec.-ft. (2,000 li.-sec.) at low water up to 495 sec.-ft. (14,000 li.-sec.) at times of high water, with a mean flow of 140 sec.-ft. (4,000 li.-sec.). As it is necessary at all times to leave a flow of 10 sec.-ft. (300 li.-sec.) in the river, it is possible to count on the diversion of a usable flow of 53 sec.-ft. (1,500 li.-sec.).

Water is taken from the river at an elevation of 2,400 ft. (732 m.) in a gorge having very steep sides and passes into the settling chambers, which are specially constructed on account of the fact that water is discharged into them from another power plant (Calypso). After passing through screens the water enters a canal which is entirely underground, lined with a smooth coat of cement in order to facilitate the movement of the water, and roofed wherever the nature of the rocks is such as to render caving probable.

The canal, which is 5 ft. (1.5 m.) wide, has a slope of 1 in. 1,000. It has an output capacity of 78 sec.-ft. (2,200 li.) with a depth of water of about 3 ft. (1 m.) and of 109 sec.-ft. (3,100 li.) with a depth of 5 ft. (1.5 m.).

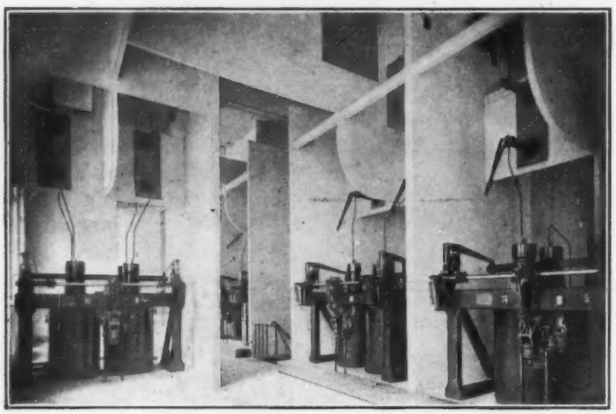
After following a distance of 2 miles (3 km.) the width increases abruptly to 5 ft. (4.5 m.), while the top remains horizontal and the bottom slopes downward at the rate of 1 in. 1,000 in successive steps; thus forming a subterranean reservoir about 2,300 ft. (700 m.) long. This is followed by an open reservoir 980 ft. (300 m.) long, 40 ft. (12 m.) wide and 5 ft. (4.5 m.) in mean depth. This reservoir itself is followed by a large compression chamber, whence the penstocks leave. The combined storage capacity is about 783,000 cu.ft. (22,000 cu.-m.), which, under the head of 820 ft. (250 m.) here utilized, represents a capacity of 19,500 hp.-hr. This reservoir, built at the head of the penstocks and permitting the storage of the entire flow for nearly four and one-half hours, serves both as a daily reservoir and a flywheel to absorb momentary fluctuation.

To assure the maximum continuity of service as well as to facilitate the operation of the plant, the equipment is divided into three independent groups, each comprising one penstock, one 3,500-hp. turbine, one 2,400-kw. alternator and one transformer.

The penstocks are boiler-plate with an interior diameter of 32 in. (81 cm.) and are designed to resist 20 per cent more than the static head. The pipe was tested at the factory 50 per cent above normal pressure. The penstocks are welded in sections of 60 ft. (18 m.) mean length, these sections themselves being assembled with flanged and bolted joints, making a total length of about 1,740 ft. (530 m.). The level of the air in the compression chamber varies from 2,400 ft. (726 m.) to 2,380 ft. (721.5 m.) according to the quantity of water in the reservoir. The floor of the station is at the 1,550 ft. (473 m.) level. However, the Pelton turbines being able to operate with hydro-pneumatization the level of water in the discharge chamber of the turbines, which is at the 1,540-ft. (469-m.) level, may be used to calculate the gross head. This is 840 ft. (256 m.). The net head after deducting the friction loss in the conduits is 820 ft. (250 m.).

The penstocks do not contain any expansion joints

or other analogous arrangement to provide for expansion. The two adjustable joints, which are parted, were provided simply to facilitate the installation of the pipe and were later made fast at the proper temperature to render these fixed joints. The displacement, which corresponds to a lengthening or a shortening of the pipe or, if movement is prevented, a molecular or tension stress in the plates, directed along the penstock, is absorbed



HIGH-TENSION SWITCH ROOM OF SOULOM PLANT, SHOWING 60,000-VOLT OIL SWITCHES

by the large massive anchorages, between which the conduit maintains an invariable length. To reduce the damage in case of rupture of a penstock, the upper end of each is made in siphon form. Then if, through rupture or any other cause, the discharge of a penstock exceeds the predetermined maximum, the water column breaks and the siphon ceases to operate. Each penstock is equipped with a Venturi flow meter. The water is discharged into the river through a tailrace 1,950 ft. (600 m.) long. The Gavarnie or Pau has an output varying from 166 sec.-ft. (4,700 li.-sec.) at low water to 1,050 sec.-ft. (30,000 li.-sec.) at high water, with a mean of 354 sec.-ft. (10,000 li.-sec.). The utilizable flow is 155 sec.-ft. (4,400 li.-sec.).

The water is taken at the 1,940-ft. (592-m.) level, where a forebay is formed by a dam. The water passes across two series of racks into two successive settling chambers, from which it enters the head canal, which has a slope of 1 in 100. This canal is 4 miles (6.3 km.) long and terminates in a compression chamber.

The "head" canal is similar to that of the Eget development. It is 6 ft. 6 in. (2 m.) wide and is able to discharge 177 sec.-ft. (5,000 li.-sec.) with a water depth of 5 ft. (1.5 m.) and 212 sec.-ft. (6,000 li.-sec.) with a depth of 6 ft. 3 in. (1.9 m.).

There is no reservoir for daily load fluctuation. Such provision is limited to a chamber of 70,800 cu.ft. (2,000 cu.m.) capacity, which forms a flywheel to absorb momentary fluctuations. This capacity is constituted by a tunnel of large section from which branch at right angles other dead-ended tunnels of similar section.

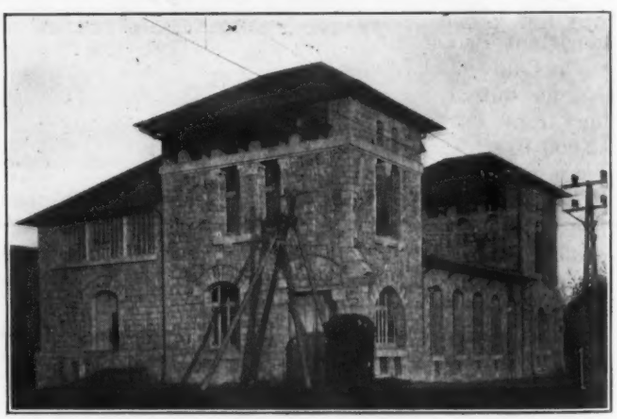
Each of the three penstocks terminates in a 3,500-hp. turbine connected directly to a 2,400-kw. alternator. Only low units are normally in service. In case of shutdown of one of the Cauterets units during low-water periods water can be taken from the Cauterets headworks to the compression chamber of Gavarnie by the aid of a special penstock.

The mean level in the compression chamber is at the 1,920-ft. (584 m.) level and the 1,540-ft. (468 m.) level. There is thus a gross head of 380 ft. (116 m.) which produces, after deducting the friction loss, a net head of 372 ft. (113 m.). The penstocks have an interior diameter of 4 ft. (1.2 m.), a length of 1,080 ft. (330 m.) and are built like those at Cauterets.

The station consists of the machine-room turbo-alternators, exciters, distribution switchboards, the transformer room, the switch room and two towers, from which the lines for high-tension current leave. Each fall supplies three turbines of 3,500 hp. and two turbines of 350 hp. Each penstock is provided with a gate valve where it enters the main turbine and also supplies a branch pipe, equipped with a hand-operated gate valve, which leads to a manifold serving to feed the two secondary turbines with one of the three conduits.

Turbines operated by the Gavarnie fall are of the Francis radial type. The water enters through a hand-controlled valve, and the proper distribution of the water to the runner is assured by the speed governor. In case of sudden closing of the gates by the governor a relief valve opens, allowing water to escape. In closing it acts slowly enough to prevent excessive pressures. Each turbine is directly connected to a 2,400-kw., 6,000-volt, 16⅔-cycle, 500-r.p.m. single-phase alternator of the revolving-field type built by the French Thomson-Houston Company. The coupling itself forms a flywheel. The main turbine and the alternator bearings are cooled by circulation of water.

Turbines operated from the Cauterets fall are of the Pelton type, with two nozzles. The water enters a gate valve automatically operated by the high-pressure water. The water is directed at the runner by two nozzles connected by an oil-pressure speed regulator. The alternator is driven through an elastic cord coupling, formed by two flywheels, one on each shaft, so arranged that their spokes interlock. The necessary water for cooling the various bearings and the transformers, also for supplying the hydraulic lightning ar-



SUBSTATION AT THE LOURDES RAILWAY STATION FED FROM SOULOM

resters, is taken from two pressure reducers, each connected to one of the two supply pipes of the exciter turbines.

Continuous current furnished by the exciters is conducted by aluminum bars to the distribution switchboard on a platform which overlooks the machine room. This switchboard is of the bench type and was furnished by the French Thomson-Houston Company. It receives 125-volt direct current for the remote control of the exciter switches, the field rheostats, the alterna-

tors, the 60,000-volt switches, etc. The functioning of the apparatus is indicated by pilot lamps of various colors. Six-thousand-volt single-phase energy is conducted by six aluminum-bar circuits to the 6,000/60,000-volt step-up transformers, which are oil-immersed and water-cooled. Oil is piped to an underground reservoir and returned through a filter by a motor pump. The 60,000-volt energy goes from the transformers to the 60,000-volt busbars over a system of copper tubes and through a high-tension remote controlled oil switch.

Three independent groups of apparatus, corresponding to each of two waterfalls, compose a half-station. The three groups may be connected in parallel through their corresponding 60,000-volt busbars. The speed governors of the turbines are controlled electrically from the same switch-board. The two half-stations can be paralleled in a similar manner by means of a switch joining the two 60,000-volt bus systems. The arrangement of the 6,000-volt busbars is such as to permit the operation of any one of the alternators with any one of the transformers.

26,000-Kw. Eget Development

The power plant at Eget, established in the upper valley of the Neste d'Aure, has profited in part by an advantageous situation. To prevent the rivers which rise in the Lannemezan plateau from drying up during the greater part of the year, provision has been made for them near their source by a canal from the Neste. A system of reservoirs receives the excess water from the heavy rains or the melting of the snows and holds it for use during the periods of small flow. This system assures to the Neste itself a minimum flow of 108 sec.-ft. (3060 li. per second) at the inlet to the canal. These various reservoirs being established to feed the rivers and not a power station, and one of them being situated in a distant valley, it was necessary to make a new lake, Lake Oulc (6,500,000 cu.m.) to provide against the low water in the others.

EACH TURBINE HAS ITS OWN SIPHON PENSTOCK

In general, the conditions of installation are the same as at Soulom. It is interesting to note that an improved method was adapted for installing the penstocks. Temperature variations in steel pipe are much greater when it is empty than when it is full of water; therefore, while the construction work is in progress the masonry anchorages must take up considerable daily fluctuations in the length of the pipe, and since the masonry requires time to set, the pipe is apt to slip, thus destroying the bond between the pipe and the masonry, or at least producing cracks in the masonry.

In order to avoid these troubles the masonry anchorages into which the pipes are embedded, as at Soulom, and intermediate anchorages are equipped with a joint that permits motion. This joint is made by embedding a pipe in the masonry through which the penstock passes. With this arrangement the penstock is free to expand and contract in length without exerting any force on the anchorage and without risk of dislocation. When the penstock is finished and sufficient time has elapsed the joint between the penstock and the pipe can be made solid, the work being done at a time when average temperature conditions exist.

The gross head is 2,410 ft. (736.5 m.), while the net head is 2,330 ft. (710 m.). The equipment of the station comprises seven electric units, each one consisting of a 5,000-hp. hydraulic turbine, a 6,000-volt single-phase alternator, a step-up transformer from 6,000 volts to 60,000 volts and two auxiliary electric units each comprising a 450-hp. turbine, one generator of 55 kw. and 125 volts and one of 175 kw. and 125 volts.

It is probable that the operation in conjunction of the Eget and Soulom plants will permit much more favorable handling of the peak loads than when they are handled independently.

Three other power plants are provided. The Cassagne plant, of 5,000 hp., on the Rivière dela Têt, supplies the line of the narrow-gage railroad from Villafranche de Conflent to Bourg-Madame. The Porte power plant, destined to supply the section from Foix to Ax-les-Thermes and the trans-Pyrenean line of Ax-les-Thermes to Ripoll, Spain, will use water from Lake Lanoux, in the Pyrenees. The third plant, fed by waters of the Sousoueou, will be built upstream from the stream station of Eaux-Chaudes. The 60,000-volt energy furnished by the power plants is transformed to 12,000 volts in the substation for distribution to the trains.

Electrification of Austrian State Railways

ACCORDING to a report from Consul-General Albert Halstead, of the American mission in Vienna, a plan has been formulated for the electrification of the state railways of Austria. At the present cost of construction it is calculated that 3,700,000,000 crowns would be necessary for this purpose. This, at the present rate of exchange, would be approximately $16,650,000. The electrification of the railways would assure transportation for Austria and thus help to make life normal, and at the same time reduce the amount of coal required for normal conditions.

Austria must try to diminish her consumption of fuel in general and for this purpose must use its streams and rivers for the production of electric power. For many years the imperial Austrian Government had been carefully studying the exploitation of water-power sites for producing electricity on a large scale. These investigations show that 2,000,000 hp. may be obtained from its rivers. This would reduce the annual consumption of coal by from 6,000,000 tons to 8,000,000 tons, or from 30 to 50 per cent.

The preliminary work has resulted in a suggestion to electrify within the next seven years 651 km. (404 miles), or 15 per cent of the total system of the Austrian state railways.

The lines to be electrified are those furthest from the coal mines; they are, at the same time, those having the greatest coal consumption per unit of capacity because of their steep grades, and they are situated nearest to the greatest sources of water power. On an average some 24,000 hp. per year is required to operate these lines, so that the use of water power would mean a saving of some 400,000 tons of coal.

After the completion of the first seven years' period of construction there would still remain 1,077 km. (667 miles), or 24 per cent of the system of the state railways to be electrified, the remainder, 2,750 km. (1,705 miles), equal to 61 per cent of the lines, not being suitable for operation by electricity.

Changing System from Two to Three Phase

By Adding Booster Transformer Both Two-Phase and Three-Phase Energy Are Obtained from Four-Wire System During Reconstruction—Permanent Provision Is Made for Two-Phase Motors Already in Service

By GEORGE H. HAGAR
Vallejo Electric Light & Power Company, Vallejo, Cal.

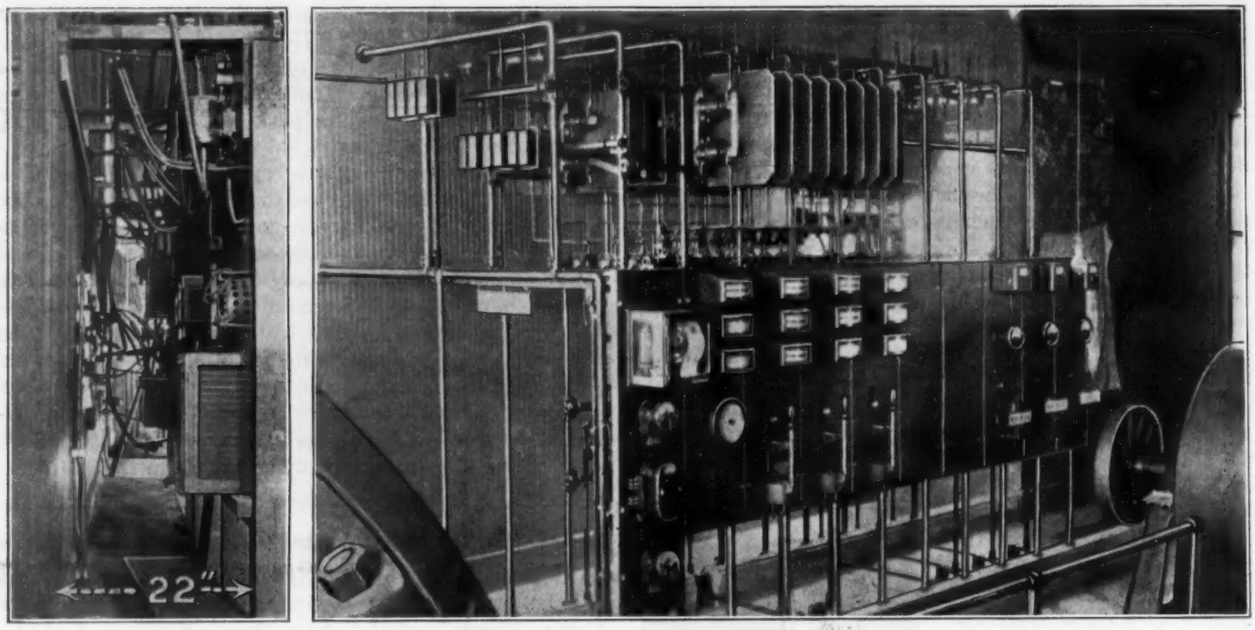


FIG. 1—OLD SWITCHBOARD REPLACED BY ONE OF MODERN DESIGN
End view of old switchboard and front view of new one. Note the small clearances behind old board and the 2,400-volt rubber-covered wire lying against the redwood wall.

THE two-phase distribution system of the Vallejo Electric Light & Power Company had been outgrown and it became necessary both to improve the voltage regulation of the distribution system and to provide modern substation equipment in place of an antiquated one. It was therefore decided to change from a two-phase, 2,400-volt distribution system to a three-phase, star-connected, four-wire system at 4,000 volts. By thus raising the voltage much of the old distribution copper was rendered sufficient for the increased load. Transformers also were rearranged for a minimum of new replacement transformers, and two-phase motors were reconnected for three-phase operation. During the transition period an interesting arrangement of transformers at the substation made it possible to supply either two-phase or three-phase loads over a four-wire system. The change was made with little inconvenience to the customers.

The Vallejo Electric Light & Power Company supplies light and power for the city of Vallejo and its immediate environs. It is a distributing company in that it distributes but does no generating whatever, buying power from the Pacific Gas & Electric Company. This supply was formerly over one 11-kv. three-phase line from the North Tower substation of the Pacific Gas & Electric Company, 6½ miles (10 km.) distant. This line also supplied the Mare Island Navy Yard and numerous shut-downs were caused by trouble at Mare Island.

At the local substation this voltage was stepped down to 2,400 volts, two-phase, four-wire, by means of a Scott-connected transformer bank of 750 kva. capacity. From this bank the power went to the switchboard of the Vallejo Electric Light & Power Company. A large part of this switchboard had been doing duty since 1895. It controlled two two-phase, four-wire, 2,400-volt feeders and three series street-lighting circuits. The entire switching and metering apparatus was mounted on the back of the board. The buses were of rubber-covered wire mounted on porcelain knobs or in loom lying on wooden braces. The instrument wiring was in loom. All this was squeezed between the panel and the wall, a space of just 22 in. (56 cm.). The clearance between wires of opposite polarity in some places was as great as 3 in. (7.6 cm.) (Fig. 1).

This system became greatly outgrown, and it was necessary to increase the capacity and to improve the voltage regulation. After a thorough investigation, a 4,000-volt, three-phase, four-wire, grounded-neutral system was decided upon.

Temporary Provision for Both Two-Phase and Three-Phase Supply

The Pacific Gas & Electric Company built a new line of No. 2/0 copper from North Tower and installed the necessary switches, separating Mare Island and Vallejo and giving both double-throw service in case of necessity. The transformer bank was replaced with one of 1,500 kva., with one extra transformer as a spare and a flexible switching arrangement whereby the spare can be put in place of any one of the others. This bank was connected delta-delta. Two-phase was obtained with the addition of a booster transformer connected

to boost from the center of and at 90 deg. from one delta leg. This made it possible to obtain both two-phase and three-phase, as is shown in Fig. 2, together with the primary connections of the various transformers along the line.

The old board was split in three sections and moved out of the way. The building was extended to give adequate space and a new switchboard was built. In designing this switchboard a great effort was made to attain simplicity and ease in operating. As is seen from the diagram (Fig. 3), the switching arrangement is decidedly simple.

The total energy purchased is measured on the first panel from the left (Fig. 1). The second shows the voltage maintained on the three phases with a curve-drawing instrument which can be plugged in on any phase. The third, fourth and fifth control the three feeders, with ammeters in each leg and hand-operated oil circuit breakers. The sixth and seventh are spare panels. The eighth, ninth and tenth control the street-lighting circuits. Each has a watt-hour meter, an ammeter and a hand-operated oil circuit breaker. In each case the geographical position of the panel with respect to the others corresponds to the geographical position of the territory served by that feeder. Thus, of the three feeder panels the north one controls the north feeder, which supplies the northern portion of the town. The three phases are called *A*, *B* and *C*. The meters are connected to *A*, *B* and *C* phases from top to bottom. The buses are *A*, *B* and *C* phases from front to back. This makes the board extremely simple (Fig. 3).

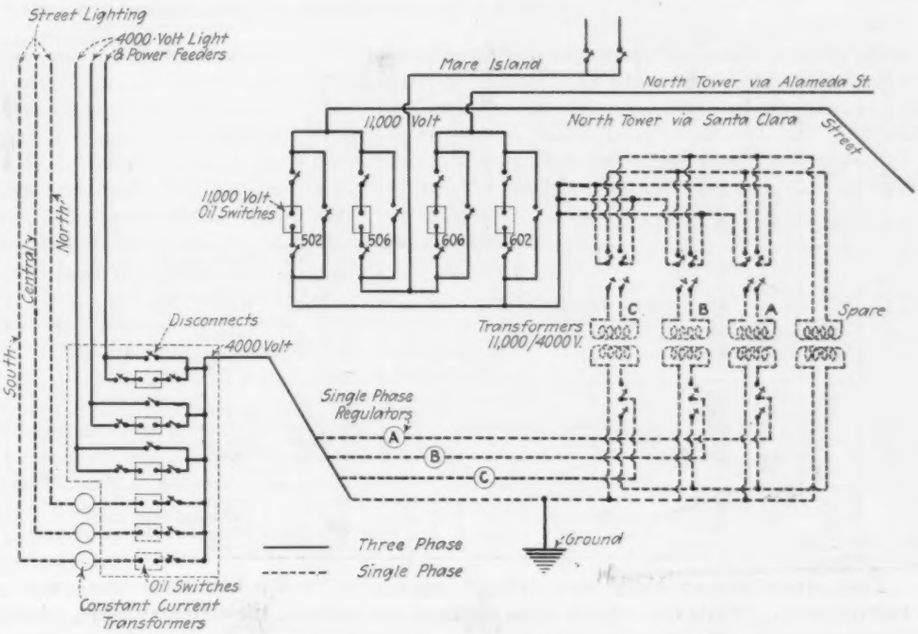


FIG. 3—SWITCHING DIAGRAM FOR SUBSTATION AT VALLEJO

The diagram of the new switchboard is shown inside the heavy dotted rectangle.

FEEDER CAPACITY INCREASED 100 PER CENT

A new primary feeder was built and the old ones were rerouted, dividing the territory into three sections. As no maps or records had ever been kept, it was necessary to trace out the phase wires on the line. These were marked on all important junction poles. The neutral wire is carried on white insulators to avoid any chance of connecting transformers across 4,000 volts. Pole-type oil switches are now being installed for isolation of trouble and to give duplicate service to the business section. The capacity has been increased so that a 100 per cent increase in load can be carried without any changes other than transformers and necessary extensions. The secondaries were rebuilt, abandoning the old two-wire, 115-volt non-grounded system for a three-wire, 115/230-volt grounded system. Power secondaries have been run separately from the lighting, improving the regulation. Except for a few scattered instances, which are being corrected as quickly as possible, the construction now conforms with the state law and good practice.

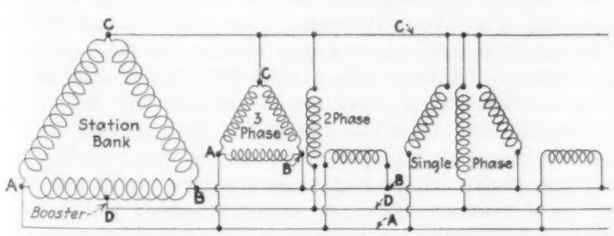


FIG. 2 — VECTOR DIAGRAM OF TRANSFORMER PRIMARY CONNECTIONS DURING PERIOD OF RECONSTRUCTION

HOW TWO-PHASE MOTORS WERE DISPOSED

After deciding to change to three-phase, no additional two-phase motors were allowed to be connected. Three-phase power was obtained from Scott-connected transformer banks until the transformer bank at the station was changed, after which it was possible to obtain three-phase from delta-connected banks (Fig. 3). The utilization of the two-phase motors then on the system presented quite a problem. Five methods were investigated, as follows:

1. To leave the motors two-phase and to use (see Fig. 4):

(a) One standard 2,300-volt transformer and one special 4,000-volt transformer.

(b) One standard 2,300-volt transformer and two 2,300-volt transformers, with a ratio of nine to one.

(c) One standard 2,300-volt transformer and two 2,300-volt transformers with 10 per cent taps.

(d) Two special 4,000-volt transformers, one with 50 per cent tap and one with 86.6 per cent tap, Scott-connected.

2. To reconnect the motors for three-phase and to use three standard 2,300-volt transformers, connected star-delta.

A combination of the second and fourth methods was decided upon as the most economical and best. Nine-to-one ratio transformers to the number of those on hand were used in the second method. In the remaining installations the motors were reconnected for three-phase.

The transformers were regrouped in banks and a schedule of changes was made. After load tests it was found possible to change a number of the commercial lighting transformers, substituting large units for several small ones, thereby effecting a saving, as the small units were then available for use in power banks.

the day of the cut-over. Since then this load has had to be balanced between the three phases.

On the day of the cut-over the secondaries of the station bank were changed from delta to star and the booster was disconnected. The old switchboard was discarded and the new one cut in. Each three-phase

SECTION FROM SCHEDULE OF TRANSFORMER CHANGES

Present Transformers					Future Banks of Transformers							
No. of Transformers	Kva.	Ratio	Load	Location	No. of Transformers	Kva.	Ratio	Connected	Move from	No. of Transformers	Kva.	Ratio	Move to
					1	7½	10	Star	North wharf				
1	5	10	2		1	7½	10	Star	Indian-Sutter and Sonoma	1	5	10	Hudson—Marin and Sonoma.
1	4	10	P										
1	1	10	1P	Indian between Sonoma and Marin.	1	10	10	Star	Hudson—Bran. and St. Clara	1	4	10	Jeffery—Marin and Sacto
1	3	10	1P							2	1	10	Stock
1	1	10	1P		1	20	10	B	In place	1	3	10	Indian—St. Clara and Sacto.
1	20	10	L		1	25	10	B	Indian—St. Clara and Sacto				
1	25	10	2P							1	15	10	Six min., ferry.
1	15	10	2P		1	25	10	Star	In place	1	7½	10	Fourth and Chestnut.
1	7½	10	3P	Indian between Marin and Sacto.	1	25	10	Star	Purchase	1	7½	9	Grant and Solano.
1	7½	9	3P		1	25	10	Star	Bay and McLane	1	1	10	Stock.
1	1	10	1P		1	50	10	L	Purchase	1	25	10	Hudson—Sacto and Marin
1	25	10	L										
4	15	10	2P		2	15	10	T	In place				
1	25	10	3P	Alameda and Kentucky.	2	20	9	T	Maine and Branciforte	1	25	10	Bay and McLane.
1	15	9	3P		1	15	10	Star	Hudson and Marin				
					2	15	10	Star	In place	1	15	9	Stock.

Each transformer bank was treated separately in cutting over. While the outside crew changed the transformers the inside crew reconnected the motors. As far as possible this was done at times which caused the consumers the least amount of inconvenience; that is, laundries and bakeries after 3 p.m., printing shops between 5 p.m. and 8 a.m., creameries on Sunday after 10 a.m.; machine shops on Sunday, motion-picture shows

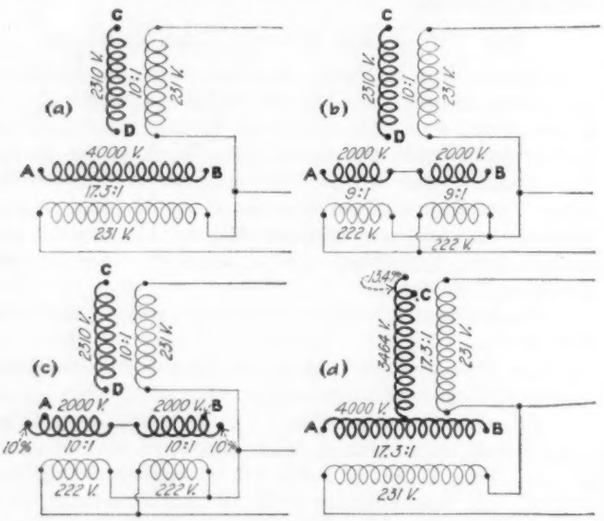


FIG. 4—POSSIBLE METHODS OF SUPPLYING TWO-PHASE MOTORS FROM THREE-PHASE LINES

after 11 p.m. In all, fifty-five motors were reconnected, the sizes varying from 1 hp. to 25 hp.

Where it was possible, owing to pin positions of the wires, the *C* leg (Fig. 2) was made the neutral. In this case the single-phase load was balanced between *A* and *C*, *D* and *C* and *B* and *C* phases. Where this was not possible the single-phase load was put on *A* and *B* phases, in order not to be concerned with that load on transformer bank was changed from delta to star on the primary side, phase rotation being taken into account in order to have the motors running the right direction. Each two-phase bank was connected as in the second method above mentioned. All these changes were made in seven hours.

The result has been entirely satisfactory. The reconnected motors have given no trouble whatever. Where the voltage regulation was formerly 14 per cent, it is now 4 per cent and the losses have been decreased proportionately. The capacity of the system is adequate for some years to come and can be added to indefinitely without disturbing operation.

Plans for National Research Institute for Canada

A COMMITTEE appointed by the Canadian Parliament to explore the question of scientific industrial research has advised that a National Research Institute be established in the vicinity of Ottawa and that $500,000 be appropriated for the site and building, $100,000 for the scientific equipment of the institute and $50,000 for salaries and maintenance during the first year.

One of the functions of the institute would be the standardization of measures throughout the country, of scientific and technical apparatus that is used in the public service or in the industries of the country, and of the quality of the materials required in the construction of public works. A second function would be to direct and supervise researches into technical processes and methods so as to assist in the development of the natural resources in Canada in the expansion of existing industries and the furthering of new industries and in utilizing materials which hitherto have been wasted.

The committee reported an investigation of the work of the United States Bureau of Standards and the National Research Council at Washington, also of the Mellon Institute at Pittsburgh.

Reactive Power and Unbalanced Circuits

The Term Reactive Power Requires Definition, Since Measurements Do Not Result in the Same Units Under Different Conditions in Three-Phase Circuits — Some Observations on the Effects of Unbalanced Voltages and Currents

By WALDO V. LYON
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IT IS the purpose of this paper to discuss rather briefly active and reactive power, power factor and the degree of unbalance in three-phase systems, and, if possible, to arrive at conclusions in regard to the most suitable conceptions of these quantities, giving due consideration to their practical application as well as to their physical significance. In order that these conceptions may have the widest applicability no assumptions should be made which in any way limit the generality of the discussion other than those which are always made in connection with commercial low-frequency circuits. It is of prime importance, for example, that the wave forms of the voltages and currents should not be restricted to the sinusoidal, and further that the resistance and inductance in the circuit should not be assumed to be constant. That we may avoid the abstractness which such a general discussion often involves, frequent recourse is made to concrete illustrations. The point taken is that one established exception disproves the rule.

The paper naturally divides itself into two distinct parts as given in the following paragraphs:

PART I

Active and Reactive Power, Power Factor

The active power at any point in an electric circuit is the average rate at which energy passes the point. This is a definite physical concept. No assumption need be made in regard to the number of conductors which compose the circuit or to the way in which the voltages and currents vary. The instantaneous power is the sum of the products obtained by multiplying the corresponding instantaneous values of the voltages and currents. With a polyphase circuit one conductor may be considered as the return for all of the others. The frequency of the power is twice that of the voltage and current. Except in the case of a polyphase circuit on which the load is balanced the instantaneous power is variable. Not only is the power variable but it is usually reversed within the period of a cycle; that is to say, the energy flows from the generator to the receiving device during the major portion of the cycle but reverses and flows from the receiving device to the generator during the rest of the cycle (Fig. 1). In general this is all that can positively be said. The reactions within the receiving device cannot be determined if only the voltage and current supplied to it are known. In fact, different physical conditions of the receiving circuit may cause exactly the same instantaneous energy flow, the effects of which on the generator are indistinguishable.

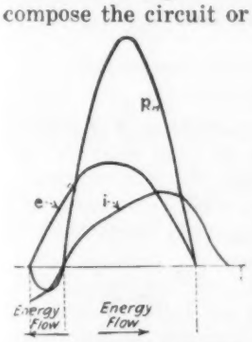


FIG. 1—USUAL POWER CYCLE OF DOUBLE FREQUENCY

The surest method of correctly analyzing the power to a receiving device is to determine the factors which cause the loss in electric pressure and the manner in which they vary. Some components of the pressure vary in such a way that electrical energy is continually absorbed by the device and transformed into another form. The active power is due principally to these components. Other components vary so that electrical energy is transformed into a convertible form and stored during one-half of the power cycle and then returned to the circuit, wholly or partly, during the next half cycle. The reactive power is due principally to these components. Before defining reactive power it is well to analyze the power conditions in a few simple types of circuits. Although these circuits are purely theoretical ones—in order that the analysis may be reduced to its simplest form—they may be substantially duplicated in practice.

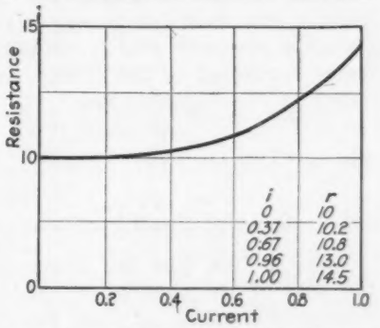


FIG. 2 — RESISTANCE VARIATION INTRODUCES THIRD HARMONIC OF CURRENT

Case I.—Non-inductive circuit, the resistance of which varies cyclically with the current, as does that of a fine metal-filament lamp. The variation of resistance with current is plotted in Fig. 2. For this assumed relation between resistance and current the latter will contain a 10 per cent third harmonic if the applied voltage is sinusoidal. The equations for voltage and current follow:

$$e = \sqrt{2}\, E_1 \sin \omega t$$

$$i = \sqrt{2}\, I_1 \sin \omega t + \sqrt{2}(I_1/10) \sin 3\omega t$$

Energy flows into this circuit in a continuous stream. It is not stored in one half cycle to be returned in the next. Since the third harmonic in the current contributes nothing to the average power, the active power is:

$$P_a = E_1 I_1.$$

The volt-amperes, however, are:

$$VI = 1.053 E_1 I_1.$$

A reactive wattmeter[1] connected in the circuit would indicate nothing:

$$W_r = 0.$$

Case II.—A sinusoidal electromotive force impressed on a circuit having constant resistance and constant inductance. This is the simplest and most usual as-

[1] A reactive wattmeter is one whose potential circuit is so constructed that the current through it leads or lags the applied voltage by substantially 90 deg., whereas in the regular wattmeter the two are in phase.

sumption. If the applied voltage is sinusoidal, the current will also be sinusoidal and of the form:

$$i = \sqrt{2}I \sin \omega t.$$

The equation for the component electric pressures is:

$$e = ri + L(di/dt)$$
$$= r\sqrt{2}I \sin \omega t + L\omega\sqrt{2}I \cos \omega t.$$

The power equation is:

$$p = ei = rI^2(1 - \cos 2\omega t) + \omega LI^2 \sin 2\omega t.$$

The average power to joule heating is rI^2 and to the magnetic field is zero. The active power is thus:

$$P_a = rI^2.$$

The *maximum* power to the magnetic field is ωLI^2. This is frequently called the reactive power. The *average* rate at which energy is supplied to or delivered from the magnetic field is $(2/\pi)\omega LI^2$. A reactive wattmeter connected in the circuit indicates the maximum power to the magnetic field:

$$W_r = \omega LI^2.$$

The volt-amperes are:

$$VI = I\sqrt{(rI)^2 + (\omega LI)^2},$$
$$\text{or } (VI)^2 = (rI^2)^2 + (\omega LI^2)^2.$$

Thus in this case the square of the volt-amperes is the sum of the squares of the average rate at which energy is supplied as joule heating and the maximum rate at which energy is stored in the magnetic field. Also:

$$(VI)^2 = P_a^2 + W_r^2.$$

Class III.—A non-sinusoidal electromotive force impressed on a circuit having constant resistance and constant inductance. In this case the current will contain the same harmonics that the voltage does. The higher harmonics in the current, however, will be relatively smaller and lag more, so that the wave forms of the current and voltage may be considerably different. Assume that the voltage is such that the current is:

$$i = \sqrt{2}I_1 \sin \omega t + \sqrt{2}I_3 \sin 3\omega t.$$

The joule heating is:

$$i^2r = r\,[I_1^2(1 - \cos 2\omega t) + I_3^2(1 - \cos 6\omega t) + 2I_1 I_3(\cos 2\omega t - \cos 4\omega t)].$$

The average heating is: $r(I_1^2 + I_3^2)$.

The power to the magnetic field is:

$$iL\,(di/dt) = \omega L\,[(I_1^2 - 2I_1I_3) \sin 2\omega t + 4I_1I_3 \sin 4\omega t + 3I_1^2 \sin 6\omega t].$$

Since the average power to the magnetic field is zero the active power is:

$$P_a = r(I_1^2 + I_3^2).$$

If the third harmonic in the voltage is shifted in phase 180 deg., the third harmonic in the current will shift the same amount and the current will have a peaked instead of a flat wave form. The effective values of both current and voltage are unchanged. The power to the magnetic field is now:

$$iL\,(di/dt) = \omega L\,[(I_1^2 + 2I_1I_3) \sin 2\omega t - 4I_1I_3 \sin 4\omega t + 3I_3^2 \sin 6\omega t].$$

The active power is unchanged.

This shows that by changing the form of the applied voltage without changing the magnitudes of the harmonic components the conditions of energy storage in the magnetic field are altered. Neither the maximum value of the stored energy nor the maximum rate of storage nor the average rate of storage over one-half of a power cycle remains constant. As long as the harmonic components of the voltage are of constant magnitude the indication of a reactive wattmeter is independent of wave form:

$$W_r = \omega L\,(I_1^2 + 3I_3^2),$$

The square root of the sum of the square of the active and reactive wattmeter readings is no longer equal to the product of the applied voltage and current.

Class IV.—A sinusoidal voltage impressed on a circuit having variable resistance and variable inductance;

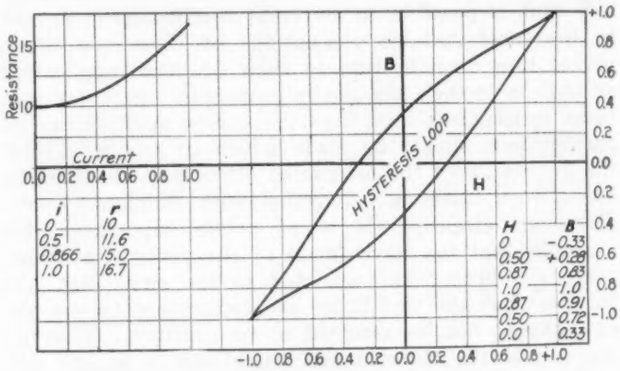


FIG. 3—CIRCUIT CHARACTERISTICS CAUSING CYCLIC VARIATIONS IN RESISTANCE AND INDUCTANCE

such as a variable resistance in series with a reactor whose magnetic circuit is subject to hysteresis. The plots of resistance and current and of flux and current are shown in Fig. 3. For these particular relations the current is also sinusoidal and of the form:

$$i = \sqrt{2}I \sin \omega t,$$

and the resistance and inductance, $N(d\phi/di)$, vary with the current as follows:

$$r = R - k \cos 2\omega t,$$
$$L = \frac{X}{\omega} + \frac{k}{\omega} \sin 2\omega t.$$

R, X and k are constants.

The joule heating is:

$$i^2r = I^2\left[\left(R + \frac{k}{2}\right) - (R + k) \cos 2\omega t + \frac{k}{2} \cos 4\omega t\right].$$

The average joule heating is: $I^2\left(R + \frac{k}{2}\right)$.

The power to the magnetic field is:

$$iL\frac{di}{dt} = \frac{kI^2}{2} + XI^2 \sin 2\omega t - \frac{kI^2}{2} \cos 4\omega t.$$

In this case the energy stored in the magnetic field during one-half of a power cycle is only in part returned during the next half cycle. The net loss in energy per cycle is proportional to the area of the hysteresis loop. The active power is:

$$P_a = I^2\left(R + \frac{k}{2}\right) + I^2\frac{k}{2}$$
$$= I^2(R + k).$$

A reactive wattmeter connected in the circuit will indicate XI^2. This however, has no definite relation to the maximum stored energy, the maximum rate of storage or to the average rate of storage during a half cycle. Nevertheless the square of the volt-amperes is now equal to the sum of the squares of the active and reactive wattmeter readings. Viewed from the

external circuit this receiving device cannot be distinguished from one which has a constant resistance of $(R + k)$ and a constant inductance of $\left(\frac{X}{\omega}\right)$. The similarity will at once cease if the applied voltage is not sinusoidal.

Difficulty of Defining Reactive Power

A consideration of these illustrative cases is sufficient to show that whereas active power has a definite physical significance, a practical value and can always be measured, reactive power is a much more difficult quantity to define or to measure. If the conception is founded on physical theory, the definition will involve the maximum stored energy, the maximum rate of storage, the average rate of storage during one-half of a power cycle or some similar quantity. This definition makes the measurement of reactive power difficult, if not impossible, except when the voltage and current are sinusoidal and the circuit constants do not vary cyclically. The reactive wattmeter is an instrument of doubtful value except in the case just cited.

The sum of the squares of the active power and either the reactive power or the reactive wattmeter reading is not in general equal to the square of the volt-amperes. This relation between the active and reactive powers and the volt-amperes is of considerable use in power calculations and might be taken as the definition of the reactive power. If this were done reactive power would be without physical significance except when the voltage and current are sinusoidal and the circuit constants do not vary cyclically. Neither would it always be possible to measure it with a reactive wattmeter. Since it would often lack physical reality, the designation "apparent reactive power" is to be preferred. Regardless of the definition that is adopted the use of reactive power in alternating-current calculations will produce nothing but approximate results except when the current and voltage are sinusoidal and the circuit constants do not vary cyclically.

Physical Conceptions of Power Factor

When an alternating voltage of any wave form whatsoever is applied to a circuit which is adjusted so that the current through it has a fixed ampere value, the power is greatest when the voltage and current have the same wave form and are in phase. This maximum power equals the product of the voltage and current.

In general, the ratio of the power that a given voltage and current do produce to the greatest they can produce is called the power factor of the circuit. This definition is generally accepted in substance if not in form. It is independent of wave form, circuit conditions or the number of phases, and, in the case of polyphase circuits, of whether the load is balanced or unbalanced. In single-phase and balanced polyphase circuits, if the voltage and current are both sinusoidal, the power factor is the cosine of their phase displacement. In three-phase circuits the maximum power is readily obtained from the general expression for the sum of the readings of the two wattmeters which are properly connected to measure the power.[1] It is:

$$P_{max} = \sqrt{V_{13}^2 I_1^2 - 2V_{13}I_1V_{23}I_2 \cos(\alpha + \beta) + V_{23}^2 I_2^2}.$$

The voltages and currents are the readings of instruments connected in the circuit as indicated by the subscripts. The angles α and β are those between these voltages and currents when they form the sides of the triangles of line voltages and currents. The maximum power is conveniently obtained graphically as shown in Fig. 4. For the given values of line voltages and line currents it is the greatest that can be developed.

Thus far the discussion has been with the sole purpose of presenting the physical facts so that logical definitions may be given the quantities reactive power and power factor. In the practical measurement of these quantities on commercial circuits it may be best to make certain assumptions or approximations in order to arrive at a result that is at once accurate enough

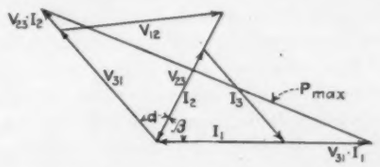


FIG. 4—MAXIMUM POWER IN A THREE-PHASE CIRCUIT

$I_1 = 56.2$ $V_{12} = 2235$ $P_{max.} = 185.0$ kw.
$I_2 = 45.3$ $V_{23} = 1990$ $\sqrt{3} I_{av.} V_{av.} = 186.0$ kw.
$I_3 = 53.7$ $V_{31} = 2000$

and at the same time not too difficult to obtain. The most common assumption made in alternating-current circuits is that the voltages and currents are sinusoidal. In a great many cases this is sufficiently accurate. When this assumption is made any receiving device may be replaced, in so far as the circuit external to itself is concerned, by one in which the resistance and inductance or capacitance do not vary cyclically. Under these conditions an active wattmeter indicates, as to be sure it always does, the average power and a reactive wattmeter indicates the maximum rate at which energy is stored. The maximum power that this voltage and current will give in any circuit—that is, the volt-amperes—is the square root of the sum of the squares of the active and reactive wattmeter readings. Thus if a right triangle is constructed whose sides are respectively proportional to the active and reactive wattmeter readings the ratio of the former side to the hypothenuse is the power factor. While the foregoing assumptions are perfectly allowable in much commercial practice it would be extremely unwise to have them form the basis for fundamental definitions.

PART II

Degree of Unbalance

The line voltages or currents of a three-phase system may be equal or unequal.[2] In the latter case they are said to be unbalanced. The most promising method of analyzing unbalanced circuits is that in which they are replaced by two balanced circuits of opposite phase order. If the voltages and currents are not sinusoidal, the analysis is rendered correspondingly more laborious and the practical measurement of the several components would be extremely difficult. The analysis shows that the copper loss for the unbalanced condition is equal to the sum of the copper losses for the two component balanced conditions, and that the reverse-phase-order current taken by a symmetrical three-phase motor is proportional to the reverse-phase-order-voltage. With a synchronous machine the constant of the proportionality may vary somewhat with the excitation and power factor. The reverse-phase-order current will also cause additional core and damper losses in a synchronous

[2] C. L. Fortescue, *Transactions A.I.E.E.*, Vol. XXXVII, page 1027.

machine. If all polyphase devices connected to the circuit are symmetrical, the sole cause of any unbalance in the line currents and voltages is the single-phase power that the circuit supplies, disregarding any unbalance in the line reactance and capacitance. If the line currents are unbalanced, the capacities of all of the generating, transforming and transmitting devices are reduced and an additional burden is thrust upon the producer. If the line voltages are unbalanced by these unbalanced currents, all symmetrical polyphase motors will take additional reverse-phase-order currents, the effect of which is twofold. The capacities of the motors are reduced and their losses are increased. The action of these reverse-phase-order currents, however, tends to restore the balance in the line voltages, although the correcting currents taken by the polyphase motors are always smaller than the disturbing currents taken by the single-phase loads. The smaller the impedance of the polyphase motors to the reverse-phase-order current, the larger will be this current, the greater will be the attendant losses in them and consequent reduction in their capacity, and the less will a given arrangement of single-phase loads unbalance the line voltage and reduce the capacity of the generating and transmitting equipment.

It has been suggested[3] that the reverse-phase-order voltages and currents be defined as the unbalance in voltage and current and that the degree of unbalance be taken as the ratio of the reverse-phase-order to direct-phase-order components. On the assumption of sinusoidal voltages and currents this definition makes the calculation and measurement of the degree of unbalance in three-phase circuits relatively simple.[4]

BALANCING EFFECT OF THREE-PHASE MOTORS

The reverse-phase-order currents taken by three-phase motors are always nearly, and may be exactly, in opposition to the reverse-phase-order currents taken by single-phase loads. In this respect these currents are similar to leading and lagging reactive currents. Three-phase motors in general will partially correct an unbalanced current condition in much the same way that overexcited synchronous motors will correct a low power factor due to lagging currents. In the latter case over-correction may be obtained, but never in the former. The power that single-phase loads have to unbalance a three-phase system is to a considerable extent under the control of the central-station engineer. If the loads are properly grouped, the resultant unbalancing may be small. On the other hand, a three-phase induction motor inherently operates at a power factor less than unity. Both unbalancing current and low power factor increase the losses in the circuit and the necessary size of generating and transmitting equipment. If the one is due to single-phase loads and the other to induction motors, both should be penalized, although not to the same extent, since the former may be largely controlled by skillfully distributing the single-phase loads between the different phases, while the latter is an inherent characteristic of the load.

When, however, the low power factor is due to a leading reactive current, such as taken by an over-excited synchronous motor, a reduction in, rather than an addition to, the power rate is often made. If this is just, it is also fair to compensate the consumer for the unbalancing current taken by his three-phase motors. If, however, the central station is looked upon as a source of three-phase power, a single-phase load should be charged an additional rate, depending upon the unbalancing current that it takes. It is just as important to distinguish between the unbalancing currents taken by single-phase loads and three-phase motors as between lagging and leading reactive currents. A three-phase motor operating on an unbalanced circuit partially corrects the fault and thus benefits the central station at the expense of its own efficiency and capacity.

[3] J. Slepian, ELECTRICAL WORLD, Feb. 7, 1920; *Transactions A.I.E.E.*, Vol. XXXVII, page 1120.

[4] W. V. Lyon, ELECTRICAL WORLD, June 5, 1920.

Fuchsine Method for Testing Porosity of Electrical Porcelain

BY W. D. A. PEASLEE

AS POROUS electrical porcelain is very undesirable in electrical work, especially where the voltage exceeds 22,000, a simple method of testing porosity is of great importance. A solution of fuchsine dye in wood alcohol has been found a cheap and efficient means of making such a test. The equipment necessary for making the test consists of a tank and a pressure pump which forces the dye into the pores of the porcelain. The penetration is extremely active and has been observed under the microscope in cleavage cracks of minute quartz crystals in the porcelain. This color contrast does not photograph well, so micrographs cannot be made, though it may be observed quite distinctly.

In making use of the test in the control of quantity production, test or control pieces should be obtained of approximately the same volume and surface area as the pieces whose condition they are to indicate. It is therefore usually most convenient simply to use part of the ware for this purpose. From a manufacturing standpoint, this means, of course, a reduction in output. The proportion of the product thus sacrificed depends to a certain extent upon the arrangement of the ware in the kiln, the kind of kiln employed and the skill with which the kiln is operated. It should not, however, exceed 2 per cent of the total output.

In tunnel-kiln practice one test piece per car is sufficient, and the percentage destroyed in testing depends somewhat on the size of the pieces fired. In intermittent kiln practice the test pieces should be so selected as to represent as many pieces of ware as possible, yet they must be sufficiently numerous to be thoroughly representative of the entire charge. It should be assured that all pieces represented by a given test piece will be within the permissible firing range and held within that range the required length of time, so that an acceptable test piece will indicate with reasonable certainty that the pieces it represents are likewise acceptable.

It is important that the test pieces be unglazed, in order that the penetrative action may be more rapid and reliable. Slightly defective pieces, such as those with clipped edges, may be used for test.

When the ware comes out of the kiln the test pieces are broken up into fragments of approximately 27 cu.in. (0.4 cu.cm.) in volume and placed in a vat containing the solution. A pressure of 200 lb. per square inch is then applied. After two hours the pressure is released and the specimens are examined. The slightest measurable porosity will show a penetration of several tenths of an inch. Bad porosity will show a penetration clear through a sample 2 in. (5 cm.) thick. If a test piece shows any penetration however, the ware which it represents should be rejected.

Welding Structural Steel Work

Saving Shown by Welding Steel Work as Compared with Riveting—Tests on Roof Trusses Far Exceed Values Required by New York Building Code

By H. B. PAYNE
Chief Engineer Electrical Welding Company of America

SUCH excellent results have been obtained through the use of electric welding for building up the structural framework for a small building erected by the Electric Welding Company of America, as compared with the same work done by riveting, that the field for this work appears to offer unlimited possibilities. In making up the 40-ft. (12-m.) span roof trusses the contract price for the riveting was $85 per truss, and from the result of the welding work it was found that this work could be done on a commercial basis at $50 per truss, allowing the same reasonable profit as for the riveting job.

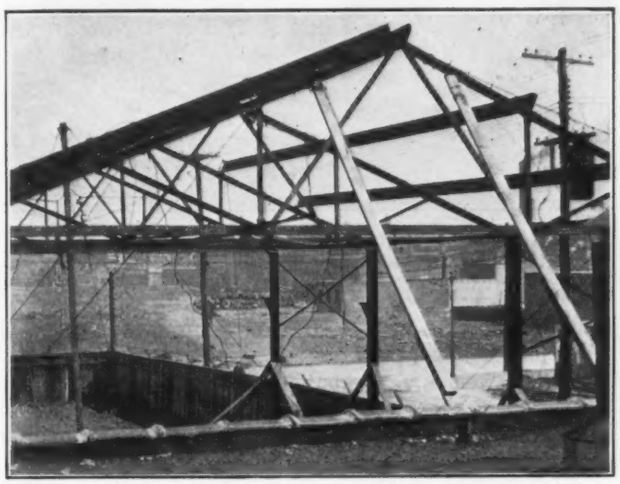


FIG. 1. FRAMEWORK DURING THE COURSE OF ERECTION

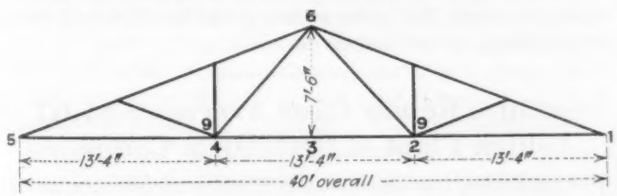


FIG. 2. ROOF TRUSS DESIGN SHOWING POINTS WHERE LOAD DEFLECTIONS WERE TAKEN UNDER TEST

While the building is not a large one, being an open shed 40 ft. x 60 ft. (12 m. x 18 m.), as shown in Fig. 1, there is no reason to assume that this method could not be applied to all classes of building construction. From a welding viewpoint the plan is perfectly feasible, and from an erection standpoint there are many points of superiority over riveting. As no gusset plate angles are needed, there is a slight saving in material from that standpoint. Owing to the fact that holes are unnecessary in the steel members, it is possible to reduce the size of the member and still retain the cross-section area of a riveted job. From a fabrication view point there is an important gain in labor-saving time. As there is no laying out of holes to be done, the fabrication becomes merely a question of cutting beams and girders to the proper length, placing them to a scratch mark, "tacking" them in and finishing the welding at leisure. The usual rivet gang consists of three men, a riveter, a holder on and a heater. The same work can be done by one man, a welder, who has nothing but a single cable to pull around after him. It is assumed that the same arrangement for setting and aligning members as now prevails in standard building construction would suit this new method.

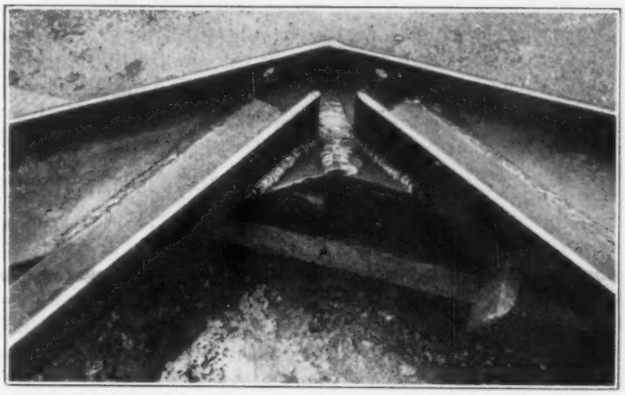


FIG. 3. METHOD OF WELDING PEAK OF ROOF TRUSS
A "V" shaped piece of metal was cut out of the center of the top member and the two ends bent down to form the upper angle of the roof. The ends were then welded together and the angle braces welded on as shown.

Building the Roof Trusses

As shown in Fig. 2, the roof truss is of the "fan" design with a 40-ft. (12-m.) span over all and a height of 7 ft. 6 in. (2.28 m.). The "T" top member was made by cutting a V-shaped wedge out of the center of the top length, after which it was bent to the proper angle and the edges were welded together as shown in Fig. 3.

Angle braces were laid down in proper position and welded into place. The entire truss was then lifted into place and welded to the columns. Columns were welded to a foundation plate as shown in Fig. 4.

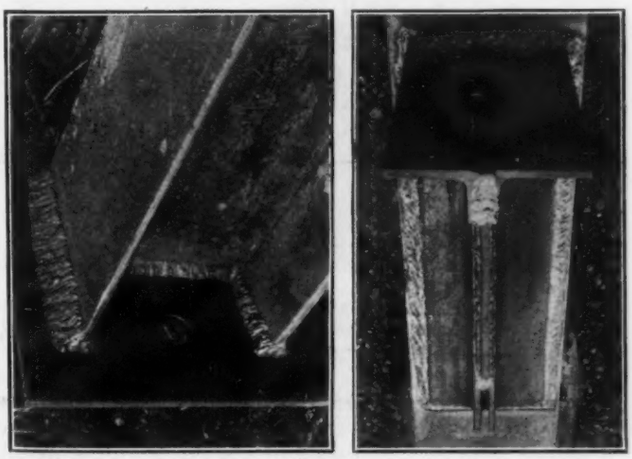


FIG. 4. "H" COLUMNS WERE WELDED ON TO A BUTT PLATE AND CRANE RAIL BRACKETS WERE WELDED ON THE COLUMNS

As no data were available showing the strength of welded structural members, the Bureau of Buildings, city of New York, requested a test before allowing the necessary building permit. The angle of the truss is greater than 20 deg., and accordingly the prescribed live load by the Building Code is 30 lb. per square foot (1.4 kg. per sq.m.) of horizontal plane, and as the trusses are intended to be set at 20-ft. (6-m.) centers the roof area to be supported is 800 sq.ft. (73.6 sq.m.). In testing these live loads the allowable live load was doubled to approach very nearly the elastic limit of the material which called for a load of 6 lb. to the square foot (2.8 kg. per sq.m.), or 48,000 lb. (21,800 kg.) on each truss of the plan. As shown in Fig. 5, the load was applied on two trusses set up on "H" section columns laid on the ground in a horizontal position. The roof purlins are 3-in. x 10-in. (7.5-cm. x 25-cm.) spruce and were doubled to carry the loads, the planking under the loads being of the same material. The two loads are concentrated over an area of about 5 ft. (1.5 m.) in width at each truss. The test load consisted of 96,000 lb. (43,600 kg.) of roofing gravel in bags. Readings were taken at different increments of the loading for deflection in the truss or members at points numbered in Fig. 2. After forty-eight hours under the maximum-load condition the load was entirely removed and readings were taken to determine the amount of permanent deflection. At point No. 3 there was $\frac{9}{16}$-in. (1.4-cm.) actual deflection under load and a permanent deflection of $\frac{1}{16}$ in (1.6 mm.) after the load had been removed. At no other point was there a permanent deflection. From the results of this test the Bureau of Buildings gave the necessary permit for construction.

A test was also made on the column brackets which will support the crane rails. These brackets were designed to carry a load of 5 tons and were tested up to 19 tons without showing any signs of failure.

POSSIBILITIES OF FUTURE STRUCTURAL WORK BY THIS METHOD

Building up structural work by this method offers a field of unlimited possibilities. No doubt the natural conservatism of builders will have to be overcome before such work becomes general. One point which might be raised is the question of the determination as to whether a welded joint is a real weld or simply deposited metal. There is, however, no more reason why an inspector familiar with welding work cannot determine the quality of the workmanship as well in this case as in that of the riveted joint. An experienced man can determine whether the metal is "burned in" or deposited without a good bond as easily as it is possible for present inspectors to determine whether rivets are drawn up tightly. From the standpoint of the large contractor and builder the field offers an interesting development. With the use of portable two-welder sets similar to that shown in Fig. 6 it would be possible to transport the equipment as readily as riveting equipment is carried from job to job.

FIG. 5. TRUSSES WERE LOADED TO TWICE THE REQUIREMENTS OF THE BUILDING CODE AND SHOWED PRACTICALLY NO PERMANENT DEFLECTION.

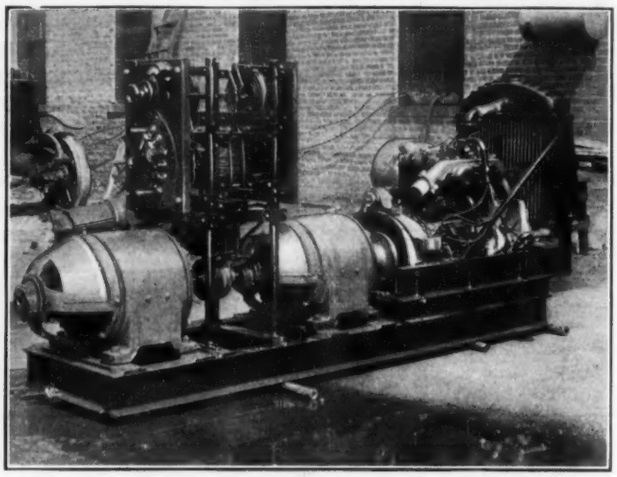


FIG. 6. GAS ENGINE SET FOR TWO WELDERS
Each machine supplies a welding current of 75 to 200 amps. with 60 volt small load and 20 volt full load. The engine is rated at 27½ hp. at 1,150 r.p.m.

As the welder is probably a more skilled class of laborer than the riveter, the smaller contractor would not be likely to maintain a welding organization for such a purpose. In this case the field of use of the commercial welder would come into play, and the welding of members would be taken care of as a contract in itself, in much the same manner as the electrical work or plumbing is now taken care of.

Armature Repair Costs Average $44.67 at Lehigh Plant of Bethlehem Company

CAREFUL cost data on the repairs of 554 armatures in seven months' time at the Lehigh plant of the Bethlehem Steel Company have shown an average cost of $44.67, or a total of $24,752. This cost, however, does not include that of changing armatures. Out of a total of 1,262 armatures repaired, it was found that about 50 per cent came into the shop for new winding, while the other 50 per cent required only minor repairs. The average time required for rewinding was 21.8 hours, and the average for all the repairs was 14.8 hours per armature.

It was found that the relation between the cost of material and the cost of labor was about three to one. Of a total cost of $24,752, $18,603 was for material. It is evident, therefore, that in reducing maintenance costs a great deal of attention must be paid to buying material.

These points were brought out by H. W. Tice, efficiency engineer in the electrical department of the Lehigh plant of the Bethlehem Steel Company, in a discussion of a paper on repair-shop practice by A. J. Standing, presented before the Philadelphia Section of the Association of Iron and Steel Electrical Engineers.

Predetermining Foot-Candle Illumination

Chart for Rapid and Accurate Calculation of Illumination Intensities—The Distribution Curve of Lighting Unit Is the Only Supplementary Information Which Is Required

By I. W. GROSS,
District Engineer General Devices & Fittings Company, New York City

IN THESE times industrial concerns are working for better light to increase factory production, and commissions are recommending and in some cases insisting on given standards of intensity for almost every use to which a lamp is put, yet there is no sufficiently simple and quick method of predetermining luminous intensities on the working plane, *i. e.*, foot-candles. The writer therefore offers a chart which greatly simplifies the work of predetermining foot-candle illumination and requires only the distribution curve of the lighting unit. The probable error in the use of this chart, over a wide range of conditions, is less than 5 per cent. The chart is therefore sufficiently accurate for most practical purposes.

There are, it is true, simple and fairly accurate methods of determining intensities on a given system where the installation is already in place, such, for example, as the Sharp-Millar photometer and the foot-candle meter, with which the illumination can be read direct by a comparatively inexperienced person.

Although the rule of allowing a certain number of watts per square foot to obtain a satisfactory illumination has been used extensively in the past, the perfection of the lighting art stamps this method as of only general adaptability and wholly inadequate to insure even approximately a given illumination on a fixed plane.

Some Approximate Methods Are Inadequate

One quite important case has come to the writer's attention where, after extensive tests had been made, a so-called illumination expert was called in, only to absorb the tests already made, make further tests and then recommend a certain value of watts per square foot on the horizontal plane. In this case the plane of vital interest was distinctly inclined to the horizontal plane; so it is clear the main point at issue was wholly missed.

Undoubtedly, the somewhat common and more ingenious rule of a given value of lumens per square foot more nearly approaches the problem from the right direction. But here again the light flux must be perpendicular to the reference plane, so that this rule cannot be universally applied, and good judgment must be exercised to get anything like accurate results.

In many cases, of course, it is unnecessary to go to refinements to predetermine the illumination desired, as for example, in halls, passageways and storehouses; but there are many other cases where a fairly accurate predetermination of intensity is highly desirable. Where such is the case, the old reliable $\cos^3\theta/H^2$ is necessary.

Referring to Fig. 1, this rule expressed as a formula becomes:

$$F = \frac{\cos^3\theta \times I}{H^2} \text{ (foot-candles)}.$$

The value of I, or candlepower, is readily determinable from the distribution curve of the lighting unit, whether bare or shaded, under consideration. H is, of course, given for any given problem, and θ the angle, must be determined for each individual point where F is to be computed. The determination of θ is not difficult; neither is the calculation of $\cos^3\theta$ or $\cos^3\theta/H^2$, but these calculations are tedious, take considerable time, and if tables are not used are liable to considerable error. Even where predetermined tables are used, the procedure is difficult, tiresome and subject to some error where interpolation is necessary for mounting heights falling between table values, also for interpolation for horizontal distances and proper angles.

Chart for Predetermination of Illumination Intensities

In order to obviate the necessity of making the above interpolations and initially constructing the table, the writer has devised the accompanying chart. Here it is possible to predetermine with a reasonable degree of accuracy the vertical illumination on a horizontal plane at any distance below the center of light from 2 ft. up to 100 ft. (0.6 m. to 30 m.) and along the horizontal plane up to a distance of 300 ft. (90 m.) on each side of the unit, thus giving a 600-ft. (180-m.) spread on the horizontal plane. In addition to the chart, only the candlepower distribution curve of the lighting unit is necessary for calculations.

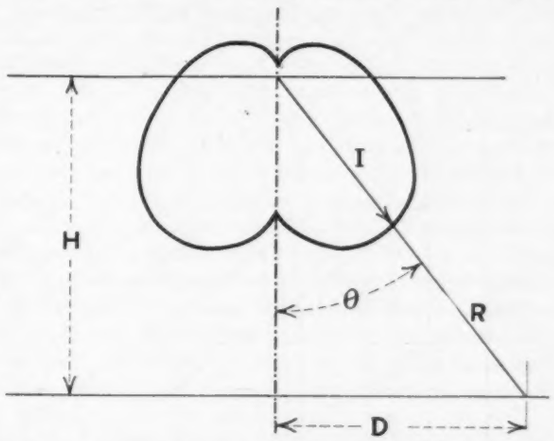
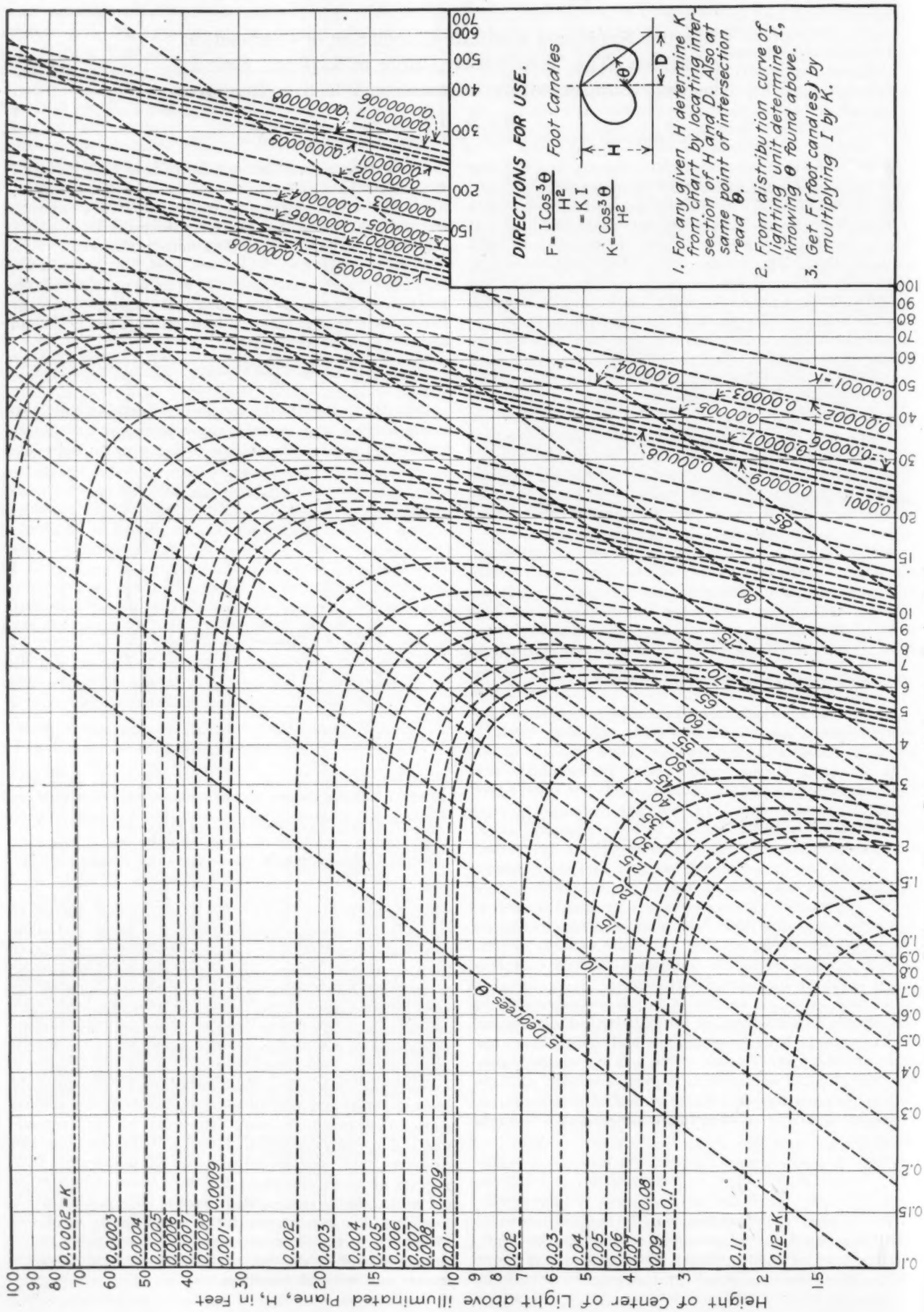


FIG. 1. CANDLEPOWER DISTRIBUTION OF LIGHTING UNIT

H = height of center of light above illumination plane-feet.
D = horizontal distance from foot of lamp-feet.
I = candlepower of unit at angle θ-candlepower.
θ = any angle.
F = perpendicular illumination on plane-foot candles.
$F = I/R^2 \cos\theta$. $H/R = \cos\theta$. $R^2 = H^2/\cos^2\theta$. $F = I(\cos^3\theta)/H^2$.

The chart has been constructed from the formula printed above and is a direct solution of this formula, represented in chart form. In order to obtain readable and usable values of H, D and K, both abscissas and ordinates have been drawn to a logarithmic scale. This permits of using the chart for very small values of H and keeps the K curves well spaced. The values of K ($= \cos^3\theta/H^2$) are drawn for $K = 0.12$ up to $K = 0.000006$, which will cover almost any conceivable range of mounting heights, horizontal distances and candlepowers met with in practice.


DIRECTIONS FOR USE.
F = I Cos³θ / H² = K I
K = Cos³θ / H²
Foot Candles
1. For any given H determine K from chart by locating intersection of H and D. Also at same point of intersection read θ.
2. From distribution curve of lighting unit determine I, knowing θ found above.
3. Get F (foot candles) by multiplying I by K.
Height of Center of Light above Illuminated Plane, H, in Feet
Horizontal Distance from Base of Lamp, D, in Feet
5 Degrees θ

The use of the logarithmic scale has caused the values of $\theta = 0$ and $\theta = 90$ deg. to vanish; but this is unimportant, since the K curves are asymptotic for $D = 0.1$ ft., and hence the asymptote is the value of K for $D = 0$ and likewise for $\theta = 0$ deg. In much the same way the curve for $\theta = 90$ deg. is not necessary, since for this value K is zero, and further, for most commercial units I is very small when $\theta = 90$ deg.

Brief directions for use of the chart are given on the chart itself. To elucidate, however, proceed as follows: Place a transparent straight edge or triangle horizontally on the chart at H equal to the mounting height of the center of light above the illuminated plane. This straight edge cuts all values of K, and the intersection of each vertical line with the line of the straight edge

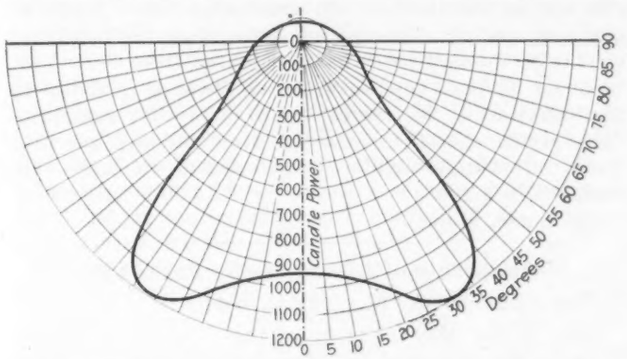


FIG. 2—DISTRIBUTION CURVE OF UNIT USED IN EXAMPLE

locates a point, for the value of D selected, which determines both K and θ. I, for the value of θ found, can then be taken from the candlepower distribution curve of the lighting unit, and this value of I multiplied by the K found at the above point determines F, the perpendicular foot-candles on the illuminated plane.

To compare the results obtained from this curve with those obtained from the standard formula, the following example has been picked at random. Assume the candlepower distribution curve in Fig. 2.

Let H = 30 ft.
I = candlepower at θ (Fig. 2).
θ = degrees from chart.
θ' = degrees from formula.
K = $\cos^3\theta/H^2$ from chart.
K' = $\cos^3\theta/H^2$ from formula.
p = per cent value of K/K'.
D = horizontal distance from foot of lamp-feet.

D	K	K'	θ	θ'	I	KI	p
0	0.0012	0.00111	0	0.0	930	1.116	107.8
10	0.00096	0.000947	18	18.5	1,050	1.007	101.5
20	0.00066	0.000640	33	33.6	1,190	0.785	103.2
30	0.00040	0.000393	45	45.0	760	0.304	101.9
40	0.00025	0.000240	53	53.1	440	0.110	104.1
50	0.00016	0.000152	58	59.0	320	0.0512	105.2
60	0.000105	0.0000985	63	63.5	280	0.0294	106.1
70	0.000072	0.0000694	67	66.8	260	0.0187	103.8
80	0.000050	0.0000468	69	69.4	250	0.0125	106.6

Average, 104.5; maximum, 107.8; minimum, 101.5

From the table it appears that the maximum error in the use of the chart as compared with the formula is 7.8 per cent and the average error is 4.5 per cent. The error in determining the angle θ is absolutely negligible, considering that it is used only in locating I on the candlepower distribution curve. It is believed that the error in the use of the accompanying chart will not exceed 10 per cent; and this should be absolutely realized in the final results, when the points of foot-candle values are plotted on co-ordinate paper and a smooth curve passed through or between all points.

Only a short use of the chart will show the great saving of time obtained over either the formula or tables, if available. Even a 10 per cent error over the formula or tables is negligible when it is considered that two lamps of the same rating differ in candlepower to some extent, and, further, that the candlepower of the unit changes slightly with the age of the lamp throughout its useful life, and greatly with the collection of dust on both the bulb and the shade. Furthermore, the reflected light will in many cases change the illumination on the reference plane by more than 10 per cent and this reflected light is virtually impossible to determine with any degree of accuracy or certainty.

It is hoped that this chart will supply a much-desired want of long standing in producing a means of arriving easily, quickly and with reasonable accuracy at foot-candle values from the distribution curves of lighting units.

Undeveloped Water-Power Rights Not Protected by Federal Constitution

THE United States Supreme Court has just handed down a decision in Cuyahoga River Power Company *vs.* Northern Ohio Traction & Light Company and Northern Ohio Power Company, a case appealed from the District Court of the United States for the Northern District of Ohio. By its decision the Supreme Court upholds the lower court, declaring that no element of contract violation as between the plaintiff company and the State of Ohio is involved and that therefore the federal courts have no jurisdiction and any dispute over clashing claims of eminent domain must be settled in the state courts.

The Cuyahoga River Power Company based its action on its articles of incorporation, filed May 29, 1908, and its subsequent proceedings for the condemnation of the property required to carry out its plans for a hydro-electric plant. These proceedings were long delayed, and while they were pending a parcel of the land involved was conveyed first to the Northern Ohio Power Company and then by it to the Northern Ohio Traction & Light Company, which prior to Feb. 24, 1914, erected a power house upon it and installed appliances for generating hydro-electric energy. This, the plaintiff claimed, was an infringement of its own contract with the state. In summarizing this contention the District Court said:

> The contention of the plaintiff is that by virtue of its charter, it has appropriated the potentialities of the river and its tributaries within the boundaries by it designated in its resolution of improvement, and that it is entitled, because of its incorporation under the general laws of the state, to exclude any use of the water power of these streams of the nature of the use which it anticipates enjoying in the future while it proceeds, however dilatorily, to make its improvements in detail and to complete its ambitious scheme. In brief, its proposition is that its charter is equivalent to a contract with the State of Ohio giving it the exclusive right to the employment of the benefits which nature has conferred upon the public through the forces of these streams to the end that, until it finds itself able completely to occupy all the territory which it has privately designated to be necessary for its use, the public shall not have the advantage of any portion not immediately occupied by it through the employment of the resources thereof by another public utility company.

This view of constitutional rights is now declared by the highest court of the nation to be "obviously without merit."

Readers' Views and Comments

Centenary of Discovery of Electromagnetism

To the Editor of the ELECTRICAL WORLD:

SIR: It is an interesting and important fact that this year is the centenary of the discovery of the phenomenon of electromagnetism by H. C. Oersted, the famous Danish scientist, on July 20, 1820. During the same year, in fact very soon afterward, André Marie Ampère worked out not only the theory of electromagnetism but also the theory of electrodynamics. These facts are stated briefly and authoritatively in the last edition of the Encyclopædia Britannica.

In an article on "Electromagnetism," Vol. IX, page 226, it is stated that "in the *Annals of Philosophy* for November, 1821, is a long article entitled 'Electromagnetism' by Oersted in which he gives a detailed account of his discovery. He had his thoughts turned to it as far back as 1813, but not until July 20, 1820, had he actually made his discovery."

In an article on André Marie Ampère, Vol. I, page 878, the statement is made that "on Sept. 11, 1820, he [Ampère] heard of Oersted's discovery that a magnetic needle is acted on by a voltaic current. On the eighteenth of the same month he presented a paper to the Academy of Sciences of Paris containing quite a complete exposition of that and kindred phenomena." This paper and a series of papers by him on the same subject were published in *Annales de Chimie et de Physique*, 1820-1828.

The fundamental importance of these branches of science, with their wonderful practical development during the century since they were discovered and formulated, makes it appropriate to recognize and celebrate the hundredth anniversary of these great events.

The fact that Ampère was able in one week to work out and put in the form of a paper for presentation to the French Academy of Sciences the fundamental principles and theory of electromagnetism is one of the most brilliant achievements in the history of science. The difficulty of the subject, the shortness of the time and the remarkable completeness even of his first paper make his work a truly amazing feat of the human mind. Not only did he formulate the theory of electromagnetism—that is, the action of a wire carrying a current upon a magnet—but he also discovered experimentally and worked out theoretically and thoroughly the phenomenon of electrodynamics—that is, the action of one wire carrying a current upon another. He also proved and gave the laws of the action of one coil or helix carrying a current upon another, proving that each acted like a magnet having a north and a south pole and these poles attracted or repelled one another just as the poles of a magnet do.

Certainly electrical science and engineering should not let this centennial pass without duly recognizing and recording the far-reaching significance of the work of Oersted and Ampère.

FRANCIS B. CROCKER.
New York City.

Depreciation and Interest Charges on Fuses

To the Editor of the ELECTRICAL WORLD:

SIR: Referring to an article, "Cost of Fuses for Service Entrances," which you published in your April 17 issue, page 897, I notice that the research engineer who prepared the figures comparing renewable-fuse maintenance with standard one-time fuses has included an item of 5 per cent depreciation. This is properly chargeable to renewable fuses as it is intended that the same case be used over and over. It is not properly chargeable to standard one-time fuses, however, because in the same calculation it is figured that each fuse is replaced once every four years (25 per cent replacements per year), so that the question of depreciation would not enter in. Incidentally prices have advanced since the article was written, on renewable fuses about 30 per cent and on standard one-time fuses about 15 per cent; also interest rates have increased from 6 per cent to about 7½ per cent. Substituting these new values in the equation, it is interesting to note that renewable fuses would not effect a saving over standard one-time fuses unless approximately 50 per cent of the fuses were replaced in a year.

LOUIS DESLOGE.
St. Louis, Mo.

Ownership of Lines Serving Railroads

To the Editor of the ELECTRICAL WORLD:

SIR: In the May 15 issue of the ELECTRICAL WORLD an editorial appeared on "Ownership of Trunk Lines Along Electrified Railways." It seems to me that this field is a large one and we should get started in the right direction. The logical division of the whole electrical industry is into three main divisions: (1) the generation of power; (2) the transmission of power; (3) the utilization of power. It is going to be almost impossible to combine all three under one ownership head, owing to the fact that the first and third divisions are confined to definite locations, while the transmission of power is flexible and can extend from one community to another. We have a large number of steam and water generating stations scattered throughout the country which are running at a low efficiency because they have low load factors and are remote from coal and water supplies. If these were connected together by a transmission system great economies could be effected.

The most economical method is to generate in large steam generating stations, develop the water powers wherever they are available and tie them all into a transmission system. There might be a large number of plants generating and feeding into this transmission system, which would in turn transmit the power to the various communities and either wholesale this power to them and to the railways or retail it in these various communities as the occasion demanded. In this way the system would be entirely flexible and the load dispatching would be handled entirely by the transmission company within its territory to the best advantage. The plant which could make and deliver power at the lowest price to the transmission company would get most of the business. There would be numerous transmission companies, which in turn would interconnect and buy and sell power from and to each other. This all means that right now we should establish standard voltages for trunk lines and secondary lines, so that the equipment will be uniform.

N. A. KEMMISH,
Public Service Company, General Manager.
York, Neb.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Posting Firemen's Records Makes Better Firing

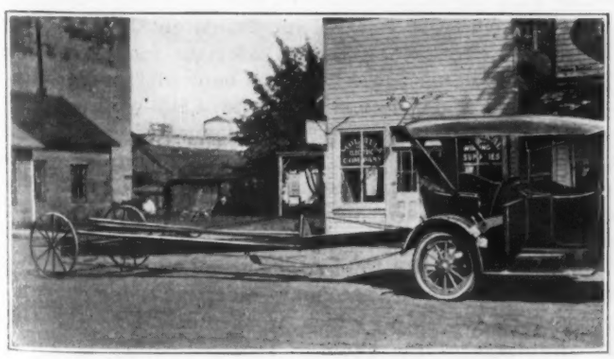
BY POSTING the efficiency records of each man's run in a conspicuous place in the boiler room of a Missouri central station a spirit of rivalry has been created between firemen on different shifts. A blackboard used for the purpose is laid out for three shifts per day for a month. In the space set aside for each shift is given the fireman's name, the total amount of coal burned and the total kilowatt-hours generated, the pounds of coal per kilowatt-hour, and, as this plant acts as a reserve to water-power service, the coal used for banking, the banked boiler hours and the coal per banked hour are also given.

Owing to the different conditions prevailing on each shift one shift cannot very well be compared with another. However, the firemen change shifts every week and the figures are kept on the board to let each fireman compare his results with those of the other men when they were on the same shift. Very gratifying results have been obtained, and the slight trouble and expense involved have been fully justified.

FRED M. RICHARDS,
Chief Engineer of Power Plants.
Empire District Electric Company,
Joplin, Mo.

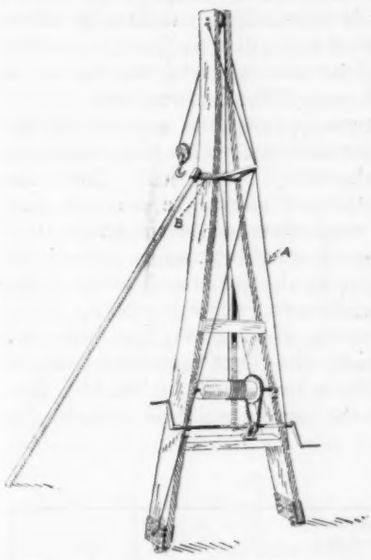
Home-Made Light Derrick Raises Eighteen Poles in Half Day

A LIGHT pole-raising derrick transported on a trailer behind a touring car has proved economical of labor and time for the Molalla Electric Company, Canby, Ore. With this rig it has been found possible to raise as many as eighteen 35-ft. (11-m.) poles in a half day with a crew consisting of three men. The derrick has also been found very convenient for taking down or moving poles along highways, one afternoon's work having accomplished the taking down of eight large 35-ft. poles and one 50-ft. (16-m.) pole. In moving poles from one point to another near by, the derrick is able to make a great saving in time as it can move a pole a distance of at least 10 ft. (3 m.) without having to change the location of the automobile which braces the derrick.



AUTOMOBILE TOWS DERRICK AND SUPPORTS IT WHEN OPERATING

The principal details of construction are two 2-in. x 6-in. arms 18 ft. long (5 cm. x 15 cm. x 6 m.), forming the frame of the machine. This is braced with No. 4 iron wire, which is tightened by eye-bolts as illustrated in the sketch. From the upper end of the derrick is suspended a single-sheave block over which passes a ⅜-in. (1-cm.) flexible steel cable used as a hoisting line. This cable is wound on a 6-in. (15-cm.) drum mounted near the lower end of the derrick, which is turned by hand through a four-to-one reduction obtained by heavy motor-cycle sprockets and chain. Handles may be attached to both ends of the shaft, but it has been found that one man is usually able to raise poles up to 35 ft. (11 m.) in length with ease. When operating, the lower end of the derrick is fastened to the front axle of the automobile by clamps. The rear wheels of the automobile are blocked to prevent movement, giving a very secure anchorage for the derrick. The derrick is braced by two poles similar to pike poles which are inserted in sockets at points some 12 ft. (4 m.) from the lower end.



DETAILS OF LIGHT DERRICK WITH WHICH THREE MEN RAISE EIGHTEEN POLES PER HALF DAY

The derrick is transported on a light two-wheeled truck which forms a trailer for the machine. The whole outfit is very light and inexpensive and may be readily handled by men less experienced than those needed for setting poles by "piking" up by hand.

Canby, Ore. E. G. ROBINSON.

Electric Current in Water Acts as Screen to Prevent Passing of Fish

TO PREVENT fish from being carried into irrigation ditches a Western man has devised an electrical screen, the scheme being to pass an electrical current through the water at the intake of the canal. It has been in use at the Utah state hatchery for some months and is now being installed for experimental purposes in Yakima County, Washington.

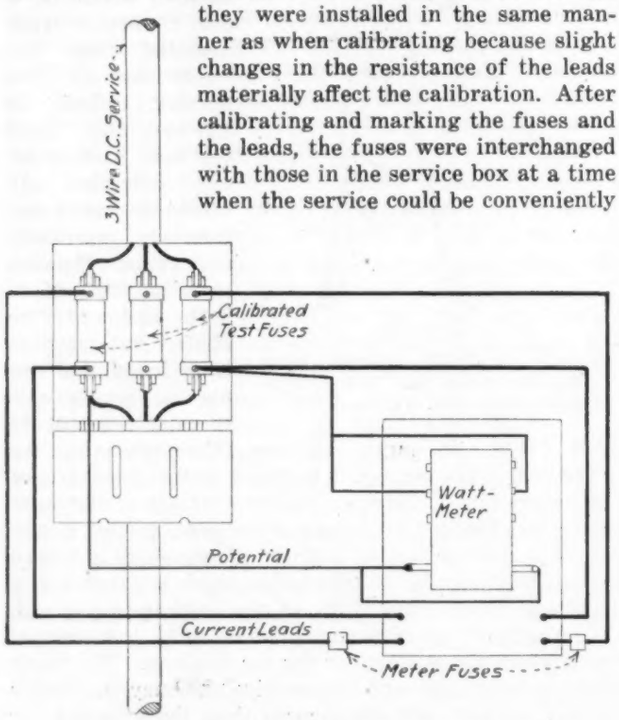
Difficulty has always been experienced in drawing irrigation water from rivers where fish abound, as the fish are inclined to follow the current into the side streams and onto the irrigated land. It was estimated that fully 40 per cent of the fish stock of some of these streams was annually destroyed in this manner. Screens or gratings were experimented with, but they collected floating material and soon became clogged or destroyed. By means of the electrical screen 90 per cent of the fish are prevented from entering the ditches.

Seattle, Wash. JOHN H. LONGFELLOW.

Calibrated Service Fuses Employed as Meter Shunts for Test

BY THE use of service fuses as direct-current meter shunts load measurements may be taken without the addition of extra leads in the power circuit, thus eliminating the danger of installing jumpers and shunts in a live circuit. This is especially advantageous where the installation is confined and all wires run in conduit, when the connecting of jumpers and the installation of shunts often becomes a very difficult procedure.

Fuses of the same type and capacity as used by the service to be tested were calibrated with the measuring instruments at the laboratory. The leads from the fuses to the instruments were marked, and on the test they were installed in the same manner as when calibrating because slight changes in the resistance of the leads materially affect the calibration. After calibrating and marking the fuses and the leads, the fuses were interchanged with those in the service box at a time when the service could be conveniently interrupted. The instruments were then connected when it was desired to make the test.



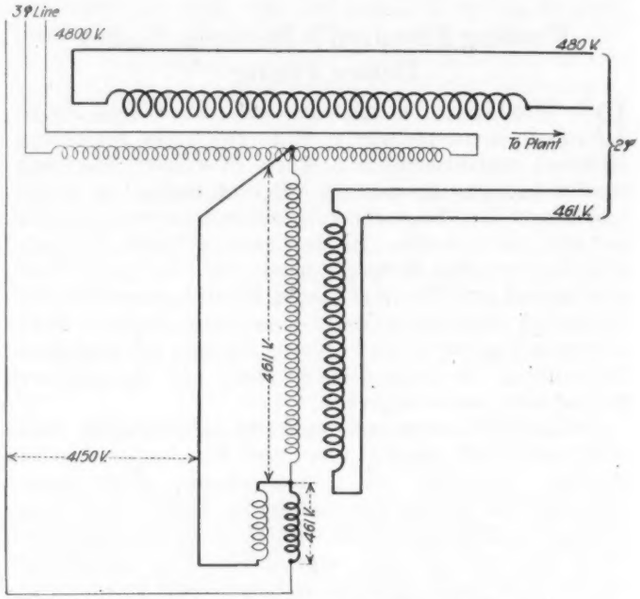
CALIBRATED FUSES REPLACE SHUNTS USED WITH PORTABLE WATTMETER

It is necessary to install two 5-amp. or 10-amp. fuses in the current leads of the measuring instrument to guard against damage in case a main fuse blows and throws an abnormal potential across the current elements of the instrument. Small fuses introduce a large resistance in the leads of the instrument, reducing the deflection of the pointer, so that these fuses should be as large as safety will permit. WILLARD S. WILDER.

Milwaukee, Wis.

Feeding Two-Phase Plant with Single-Phase Transformers

TO FURNISH service to a two-phase load from a three-phase system, six 100-kva., single-phase transformers and one 50-kva. transformer were used in an emergency by the Consumers' Power Company, Jackson, Mich. Although Scott transformers had been ordered, before their arrival this emergency operation was necessitated by failure of a 600 kw. steam unit in the plant of the Advance-Rumely Company. These 100-kva. transformers were connected in two banks of three each with both high and low sides in parallel. To secure two-phase energy at 480 volts a Scott connection was made by connecting a lead from one bank to the middle points of the primaries of the other bank.



SINGLE-PHASE TRANSFORMER ARRANGED TO SUPPLY TWO-PHASE MOTORS

Small transformer used to boost voltage on one phase

In the accompanying diagram only one transformer is drawn to represent each bank of three. This gives a "T" connection, but when the 4,800-volt, three-phase line was connected to the three extremes of the arrangement the resulting secondary voltage was lower in the phase which corresponded to the first bank of transformers.

To correct this, a 50-kva. transformer was inserted in series with the primary side of this bank and connected so as to boost the voltage approximately 10 per cent. The low-voltage side of the transformer (connected for 480 volts) was placed between the bank of transformers and the 4,800-volt line. Then the 4,800-volt winding of the 50-kva. transformer was connected across the primary side of the bank, but connected with leads reversed, so that the voltage induced would boost the voltage impressed on the high side of the bank. This resulted in a voltage of 4,611 on the bank, which was raised from the voltage of 4,150 by the 461 volts of the boosting transformer. On the secondary side the voltage on the phase was 461 volts, which was sufficiently near the rated voltage of the motors. This temporary arrangement operated very satisfactorily and remained in service until the transformers which had been ordered were received.

In making the "T" connection in the transformers a hole was drilled in the back of each transformer case near the top and a bushing was set in, through which the third wire was brought out of the case. After the transformers were disconnected the hole was tapped and a pipe plug was screwed in to stop the opening.

Consumers' Power Company, H. H. STEPHENS,
Battle Creek, Mich. District Superintendent.

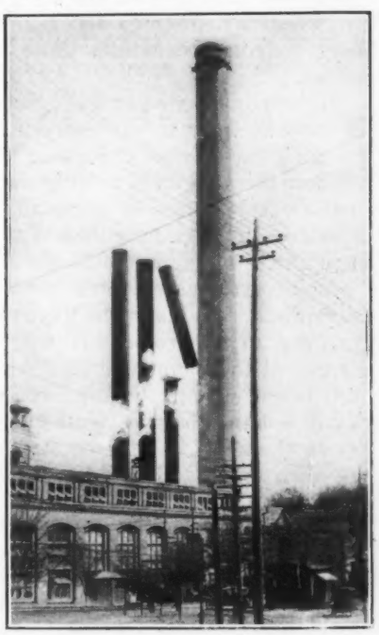
Cost of 2,500-Kw. Extension of New England Central Station

ABOUT a year ago a New England steam-driven central station completed an extension of 2,500 kw. capacity at its plant, and the final itemized cost of the work, which was done on the cost-plus basis by an outside engineering organization, was as given in the following table:

Engineering cost	$ 9,534.16
Services of construction engineers	27,300.00
Office at works	7,999.00
Insurance	1,618.52
Temporary construction	3,642.85
Building	62,285.77
Machinery foundations	2,389.02
Boiler plant	45,979.27
Draft system	2,995.13
Feed-water system	2,958.47
Condenser system	45,281.80
Piping	30,930.33
Coal and ash-handling machinery	9,212.48
Generating equipment	44,827.89
Switchboard and wiring	7,116.81
Auxiliary equipment	452.06
Construction equipment	2,060.90
Material supplied from central station stock	2,920.43
Interest on construction loans	12,687.37
Total $125 per kilowatt additional rating	$322,192.16

New Stack Holds Tackle for Dismantling Old Stacks

BY MEANS OF tackle supported from the top of the new concrete stack of a plant of the Little Rock Railway & Electric Company three old steel stacks were dismantled. The height of the new stack is about 285 ft. (85 m.), its diameter 20 ft. (6 m.) at the bottom and 15 ft. (4.5 m.) at the top. The old stacks were 150 ft. (46 m.) high and 7 ft. (2.1 m.) in diameter. As there was no ladder on the outside of the new stack, about three days was taken in rigging up the tackle at the top of the stack. Each one of the steel stacks was taken down in three sections, and it required about eight days for each stack to be taken down.



TACKLE FOR DISMANTLING OLD STACKS WAS ATTACHED TO THE NEW

JACK ABBOTT,
Little Rock, Ark. Chief Engineer.

Conditions to Be Met in Paralleling Interpole Generators

FIVE conditions must be met to operate compound-wound interpole generators in parallel: (1) The machines must be adjusted for the same no-load voltage; (2) they must have the same polarity; (3) they must have the same external voltage characteristic (change of voltage with load) both with series field out of circuit and with series field in circuit; (4) the series-field circuits of the machines must have resistances inversely proportioned to the ampere ratings, that is, the series field circuit of a machine rated for 1,000 amp. must have one-half the resistance of a machine rated for 500 amp; (5) the equalizer resistance must be low.

Conditions Nos. 1 and 2 (equal no-load voltage and same polarity) need no explanation. To explain condition No. 3 it must be remembered that the external voltage characteristic of a generator is the relation between terminal voltage and load. If the voltage rises with load, the machine is overcompounded and is said to have a rising external characteristic, while if the voltage falls with load it has a drooping characteristic. Any machine to compound properly must have a drooping characteristic when operated as a plain shunt machine.

To test this, the machine can be loaded by taking the current off the equalizer terminal instead of the regular main. It does not make any difference what the cause of the droop is, so long as it exists, and sometimes the engine speed dropping with load will give a drooping characteristic to a machine which otherwise would not droop. An interpole machine with its series field cut out may or may not droop, this depending on the effect of the interpoles. Sometimes they compound and give a rising voltage with load and sometimes the opposite.

After setting the brushes on no-load neutral, if paralleling trouble still exists, test the external characteristic of each machine with the series field out of circuit. If the test shows a rising curve, it will be necessary to shift the brushes forward with rotation until the curve becomes drooping. This may bring the brushes to a place where they will spark, and if so, the droop may have to be obtained by some other means. One means of producing droop is to have the driving speed drop off with the load, but when the generator is driven by a synchronous motor this cannot be done.

As a last resort, the droop can be secured by inserting a resistance in series with the armature. The amount of droop, which should be 2 per cent or more of rated voltage when the machine is operated without the series field, must be very nearly the same in each of the machines to be paralleled. In addition to having the same characteristic curve with the series field out of circuit, each machine must show the same characteristic curve with series field in circuit.

In regard to condition (4), machines of the same type will have the same series field resistance without adjustment, but if they are of widely different types—for instance, an engine type and a turbo type—extra resistance may be required. The machine which has too little series resistance in proportion to its rating will grab the load because it will get more than its proper share of compounding current, the extra current coming from the other machine through the equalizer.

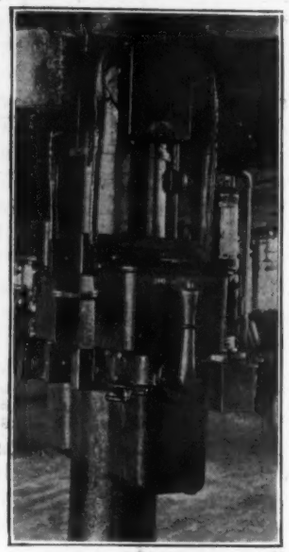
Cleveland, Ohio. JAMES DIXON.

Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Method for Mounting Starters on Round Column

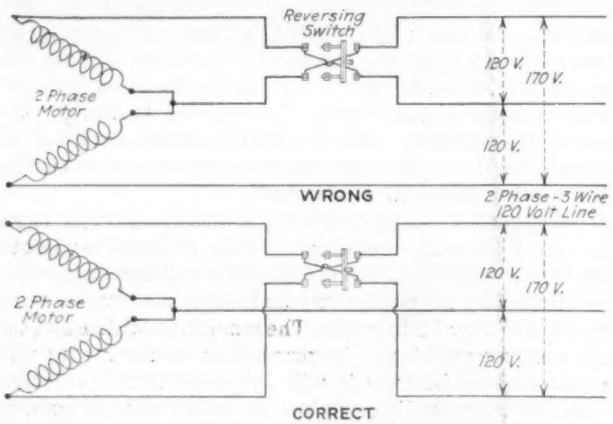
A SIMPLE and substantial method for mounting two starters for 25-hp. motors on a round column, as shown here, makes use of four wooden strips held to the column by long ½-in. (1.3-cm.) bolts. Four bolts hold each pair of the 2¼-in. x 3¼-in. (5.6-cm. x 8.2-cm.) wood strips and the starters are bolted to the strips, one on each side of the column. These starters control 25-hp. motors in the New England Westinghouse plant which are driving groups of machines adjacent to the column. The mounting is easy to make, is strong, conserves space and is economical. It is well adapted to control of group drives.



TWO MOTOR STARTERS SECURELY MOUNTED IN SMALL SPACE

Reversed Connections Cause Fan Motor to Heat

IMPROPER connections on a reversing switch recently caused serious overheating of a two-phase fan motor used in ventilating a large New York theater. This fan was intended to be run in both directions, for drawing air out of the theater and for forcing air into it. Usually the fan drew the air out of the theater and operated satisfactorily when running in this direction. However, when the reversing switch was thrown, the motor overheated in about three minutes.



IMPROPER CONNECTIONS OF REVERSING SWITCH WHICH CAUSED MOTOR TO HEAT

Investigation showed that the reversing switch was connected across the neutral and one outside wire of the two-phase, three-wire line. With this connection, when the fan was reversed to draw air into the theater, one phase of the motor received 170 volts instead of the 120 volts for which it was designed, and consequently the motor overheated. To remedy the trouble the neutral wire was connected straight through to the motor, and the two outside wires were connected to the reversing switch. After this change was made the motor operated in both directions without any further trouble.

New York, N. Y. FRED SOLLER.

Gaging and Adjusting Motor Air Gaps

GAGING the air gap of an electrical machine, besides giving warning of danger from rotor rubbing, serves also as check on bearing wear. A new motor should always have its air gap checked before starting, as well as a motor that has been taken apart and reassembled. If the belt has been shifted to pull in a different direction, gaging should be done before and after the belt is put on. The frequency of gaging motors in service depends on the drive, but as motors are ordinarily cleaned at certain intervals the gaging can be done at the same time. In the plant with which the writer is connected the air gap is checked up every two weeks. Belt, chain and gear drives ordinarily cause more bearing wear than those that are directly connected.

Ordinarily an air-gap gage comes for each motor, but an experienced man can carry a few different sizes and by using the largest gage that will go into each motor tell how the air-gap is holding up. It is even preferable to use various sizes of gages to find out if the air gap is decreasing, rather than to take a minimum-size gage and use that until the air gap decreases to it.

To check for an eccentric rotor, mark one spot on the starter and then insert the gage at that point for various positions of the rotor. If the rotor is not true, the air gap at this point will vary when the rotor is turned. If it is out enough to cause trouble, the rotor should be put in a lathe to investigate the cause. If the trouble lies in the shaft, it may be straightened or replaced. If the cause is due to high laminations, they can be ground off.

The stator laminations also may be uneven. To detect this condition mark one spot on the rotor and turn the rotor to various positions, inserting a gage each time at the marked point on the rotor but for various points on the stator.

If thin slat wedges warp they should always be attended to as the coil may work out and rub on the rotor. Motors having adjustable heads are provided with bolts (two on each head) designed to hook onto the frame and threaded on the other end with a nut outside the head. By raising or lowering these nuts the heads may be shifted up and down or sideways. When

adjusting the air gap the belt must be taken off or made very slack, and for direct-connected motors the coupling should be separated. It is generally necessary to make the gap at the top of motor slightly large to allow for the rotor rising when the heads are tightened up again.

With the heads loose the motor should be adjusted by means of the adjusting bolts so that it will have a clear gap all around. Care should be used to make the gap even on both ends of the rotor. It is customary to adjust the air gaps to give a slightly greater clearance on the side where wear will come—*i.e.*, in a belt drive on the side where the belt pulls and in direct-connected motors on the bottom.

After the air gap is adjusted and the heads are tightened the rotor should be moved (not rotated) in all directions to see that it cannot rub.

H. L. HAYES,
Woodland, Me. Chief Electrician.

Spare Parts Required for Motors in Steel Mills

IN A STEEL mill motor-driven equipment consisting of ten direct-current mill-type motors working within their rated capacity usually requires a stock of "spares" comprising one complete motor, one complete armature with bearings, one commutator, two complete sets of armature coils, one complete set of field coils, one complete set of brush holders, two sets of brushes, besides miscellaneous insulation, band wire, etc. This statement is based on the assumption that not more than five or six of the ten motors are used on severe reversing service subject to plugging and that the remainder of the motors are doing comparatively light work. Unless the service is unusually severe, the number of motors could probably be increased to fifteen or eighteen without adding to the number of "spares." If the number of motors were increased to thirty, another spare armature with bearings, an additional set of armature coils, two extra sets of brushes, and one more commutator should be added to the reserve stock.

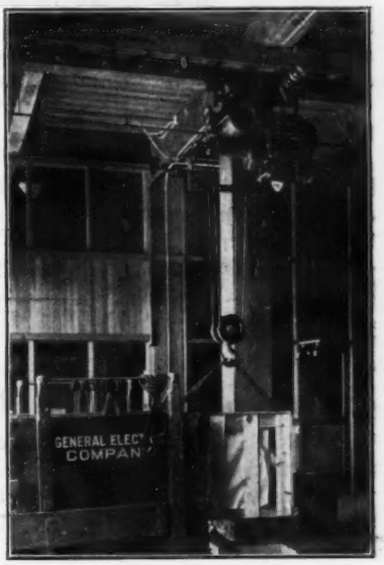
Other things being equal, speed is the greatest factor in determining the life of mill motors on reversing service. Slow-speed motors give longer service before repairs are required than higher-speed motors when operated at the same load. Alternating-current squirrel-cage motors, driving fans, pumps, saws or any constant-speed, non-reversing machines should have one complete spare motor for the first ten motors of a kind in service. In addition, there should be one set of stator coils and bearings for the ten motors, two sets for twenty-five motors and three sets for forty motors of a kind. These figures apply to motors up to 75 hp., rated at 500 r.p.m. or 750 r.p.m.

Large alternating-current motors of say 500 hp. or over are usually of such slow speed and so well built that one-quarter of a set of stator coils with insulation, one set of bearings, one set of brushes, one-quarter of a set of brush holders, etc., will be found sufficient material to keep in the storeroom for emergencies.

If the plant is divided up into sections, each section should carry its own spare parts, such as armatures, bearings, field coils and complete motors if necessary. This may seem a rather expensive procedure, but the cost is small compared with the total cost of the equipment in a steel mill and considering the loss that would result from extended shutdowns due to failures of electrical equipment. The information for this article was obtained from papers presented by C. A. Menk of the Carnegie Steel Company, Munhall, Pa., and T. E. Tynes of the Lackawanna Steel Company, Buffalo, N. Y., at a convention of the Association of Iron and Steel Electrical Engineers.

Monorail Hoist Saves Time in Loading Trucks

A 3-TON monorail electric hoist at the San Francisco warehouse of the General Electric Company handles material for a cost of approximately 1 cent per ton, with a saving of from 60 to 90 per cent of time of manual loading on low-bed trucks with heavy material. There is 90 ft. (27 m.) of track laid out in the form of a "T," one arm of which runs to the railroad spur, the other arm to the storage space, and the stem of the "T" runs to the truck-loading platform. The rail is bolted to a 12-in. x 12-in (30-cm. x 30-cm.) beam slung from the ceiling by 2-in. (5-cm.) strap-iron stirrups. A 220-volt direct-current reversing motor furnishes the power.

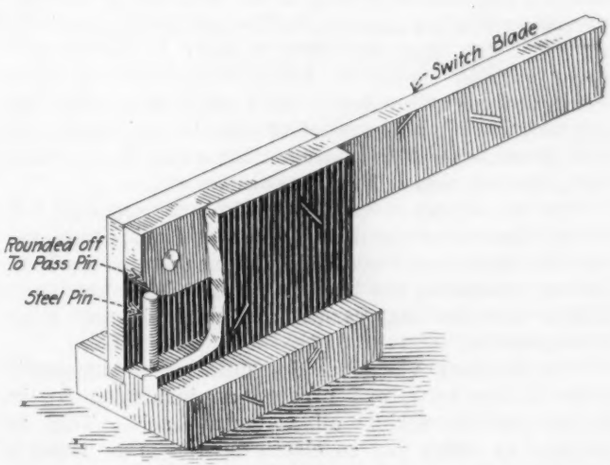


THIS HOIST DOES THE WORK OF FIVE TO TEN MEN AT 1 CENT PER TON

San Francisco, Cal. ERNEST BURCHARD.

How to Put 90-Deg. Stop on Knife Switches

FOR applying a 90-deg. stop to a knife switch a steel pin may be used, as shown in the accompanying drawing. The procedure for applying the stop is as follows: Pry loose the hinge pin and the washer which is spun on. Drill a hole between the contacts



DETAILS FOR PLACING 90-DEG. STOP ON A KNIFE SWITCH

into the base of the switch and insert a piece of $\frac{5}{32}$-in. (4-mm.) drill-rod steel. The hole may be drilled through the copper block since the pin will be held in place by the switchboard panel and the switch blade. It is preferable to make a tight fit for the drill rod, but in any case the steel pin is prevented from falling out by the switch blade. Slightly round off the lower corner of the switch blade just enough to pass the pin as shown in the sketch. The other corner of the blade must remain square. Reassemble switch blade and spin on the washer to make a good contact between the hinge post and the blade.

The drill rod should be copperized by treating with blue vitriol to prevent rusting. A $\frac{5}{32}$-in. drill-rod pin is suitable for switches up to 300 amp. Only one blade of a multipole switch need be equipped with a stop. This method may be used on any switch which has square ends on its blades. Stops of 90 deg. are not always desirable, but in many cases they are necessary where space on the panel is limited.

Atlas Electric Devices Co. H. E. WEIGHTMAN,
Chicago, Ill. Chief Engineer.

Varnishes to Use for Electrical Work

VARNISHES for electrical machines vary in general from the clear baking varnishes to the air-drying varnishes and the finishing varnishes. Baking varnishes are of course superior to any of the others as insulators. Air-drying varnishes come next, while finishing varnishes are used only to protect the under coat of insulating varnish against moisture and to provide a smooth surface which will not become dulled when the apparatus is cleaned of oil and dirt with a benzine-saturated cloth.

A fact of primary importance concerning insulating varnishes, and one which is not generally understood by repairmen, is that their dielectric resistance increases directly with the length of their baking or drying period, the slow-drying varnishes giving the highest degree of insulation and flexibility. Slow-drying varnishes contain higher percentages of gums and oils which blend as the solvent gradually evaporates, whereas the highly volatile material used in quick-drying varnishes evaporates so rapidly that blending is impossible and the result is a granular, crystalline coating which soon becomes a mass of minute moisture-absorbing cells. In the two classes of baking varnishes black varnish should be selected in preference to clear varnish in all cases where a transparent coating is not essential, as the black varnishes produce a more flexible and better insulating film than the clear varnishes of their respective class. Clear varnish should be baked from eight to twelve hours or more at 100 deg. C. (212 deg. Fahr.). This baking varnish is usually proof against oil, acid and water and is employed for impregnating coils, linen, cotton, tape, canvas, paper, fiber, armatures, etc.

The air-drying varnishes dry in from one-half hour to two hours, are moisture-proof and acid-proof to a certain extent and are fairly good insulators. As in the baking varnishes, the black varnish is better and more elastic than the clear varnish and should be used whenever possible.

The finishing varnishes dry quickly, in one-quarter hour to one hour, and produce an insulating coating which protects against oil, water and acid. They are neither so tough nor so elastic as the other types of varnish and are not intended for use as insulators.

Qualities to Look For in Selecting Brush Holders

THE following are the most desirable features of brush holders. The brush holder should:

Be cheap, simple and strong.
Quick to follow an imperfect commutator.
Easy to keep clean and able to operate even when dirty.
Small, covering as little of the commutator as possible.
Not liable to catch and injure operator's hands.
Have easy but sure spring tension, adjustable while running.
Have no tendency to chatter or bounce.
Be constructed so that it is easy to renew brush.
Easy to see when brushes are worn out.
Impossible for brush to stick in holder and should be constructed for long life of brushes.

The various holders in common use can be judged for their quality by their fulfillment of these points.

Any holder may cause friction heating due to too heavy tension when handled by ignorant operators. Brush tension should be uniform and not over 5 lb. per square inch (0.4 kg. per sq.cm.) or under 2 lb. per square inch (0.16 kg. per sq.cm.), depending on the type of holder and service conditions. Any loose-box type must have some clearance between brush and box to prevent possible sticking in dirty or oily places. On the other hand, too much clearance allows chattering. Either sticking or chattering may cause sparking.

Brushes for box holders must have ample pigtails or shunts to carry current directly from brush to arm; otherwise current will go through springs and joints, causing heating which draws the temper of springs, pits the pivots and causes arms to stick. In general, a radial brush gives greater friction for the same pressure than a sloping brush. The brush and moving parts of the holder should be light so that the spring can move them quickly and keep the brush on the commutator. This is particularly important in high-speed or vibrating machines.

There are only two kinds of trouble that can be cured by changing holders. These are heating by excessive friction and sparking or kindred troubles due to poor contact. Heating by excess friction is not uncommon. If tension is reduced enough to eliminate heating, there may not be enough pressure to make good contact and the sparking will be bad. In such a case a different holder with better spring action will be necessary. Commutator trouble due to poor contact is fairly common. Engine-shaft throw, poor foundations, gear drive, bent shaft, commutator out of "true," worn bearings or bad belt splice may cause the commutator to jump away faster than the holders can follow. This results in sparking, which burns away the copper, leaving a gray surface and high mica. When the cause cannot be eliminated a cure can sometimes be effected by using a more lively holder.

In general, all moving parts should act freely without binding but should not be loose enough to rattle. Spring tension should be heavy enough to prevent sparking. Spacing should be accurate within half a bar. Studs must be firm so that holders cannot vibrate. Holders should be set down close to the commutator, in general not over $\frac{1}{8}$ in. (3 mm.) away. If holders are set too far away, there is a great tendency for them to bounce around and chatter. Holders should be staggered so that the commutator will not wear in ridges.

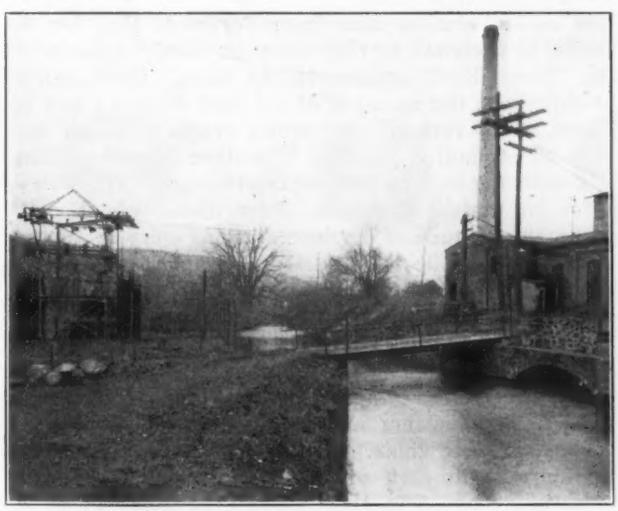
Cleveland, Ohio. JAMES DIXON.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Reliable Power Spells Industrial Salvation

AN AUTOMOBILE trip through any part of New England, declared Samuel Ferguson, vice-president of the Hartford (Conn.) Electric Light Company, in a recent address, will show how early New England factories were built on all available streams. There are now three classes of such factories: "Prosperous," "struggling" and "abandoned." The first-named have rail connections and have supplemented mechanical water power with steam, which is either now in use or in turn has been supplemented by electricity. The "struggling" factories also have steam plants, but labor under the disadvantage of carting fuel. The "abandoned" plants are evidence of the impossibility of competing when handicapped by unreliable power.



TYPICAL FACTORY WITH WATER, STEAM AND ELECTRIC POWER

The danger to New England as an industrial center, the speaker said, lies in the absorption of labor by the Middle West, the cost of fuel and lack of transportation facilities. The evolution of the power development of a typical New England factory presents the following stages: Originally operated wholly by water power; a steam engine added to supplement the stream in time of low water; more steam equipment installed to care for business the year around; the addition of electric motors for further increases; the abandonment of the steam apparatus, replacing the same with electric motors. Frequently there is a final step which is not sound, the abandonment of the waterwheels on account of the superior speed regulation and flexibility of the electric drive.

The first five steps may be seen by many a roadside—the mill-pond, the steam plant, either in operation or dismantled, and the high-tension wires running to transformers installed beside the factory. These same high-tension wires are becoming the salvation of the struggling plants and are even bringing to life abandoned ones where labor is still available.

$106,264 Profit from Merchandising Departments

OPERATION of the merchandising and jobbing departments of the subsidiary companies of the United Gas & Electric Engineering Corporation for the year 1919 shows a profit of $106,264 on a gross business of $597,653. A comparison of the gross revenue, expenses and net earnings of the merchandise and jobbing departments during the past four years follows:

Merchandise and Jobbing Departments:	1919	1918	1917	1916
Gross Revenue	$597,653	$471,660	$485,744	$429,265
Expenses	491,389	424,648	484,495	457,294
Net earnings	$106,264	$ 47,012	$ 1,249	*$ 28,029
Promotion Expenses:				
Total promotion expense charged to gas, electric and steam operations	$ 74,443	$ 61,169	$ 83,695	$118,214
Excess or deficiency of merchandise and jobbing earnings over company's total promotion expense	$ 31,821	*$ 14,157	*$ 82,446	*$146,243

* Deficit

The items, promotion expenses, are charged to gas, electric and steam operations and were not charged direct to the cost of merchandising and jobbing. In 1917 the company began to change its policy of operating the sales departments and planned to make the profits of this department sufficient to pay all the department expenses and ultimately to yield sufficient profit to pay all of the promotion expenses of the company in soliciting and advertising for new business. In 1919 this goal was reached and the company's total profits exceeded all expenses by $31,821.

Pensions for Employees of Ontario Hydro-Electric Commission

IN accordance with an act passed by the Ontario Legislature, the Ontario Hydro-Electric Commission has inaugurated pension, insurance and sick-benefit plans for male employees and savings accounts for women employees. The pension will be an annual payment of one-eightieth of the pensioner's average salary for the previous five years, multiplied by the number of years he has been in the service. In the savings accounts to be opened for each woman employee, 5 per cent of her salary will be deposited each year, and the amount thus accrued will be paid to her when she leaves the service. No assessment to cover the cost of the benefits is to be made on the employees, about 2,500 of whom will be affected by the plan.

Industrial Heating Display in Chicago

BY A. F. ALLSOP
Industrial Heating Engineer Commonwealth Edison Company, Chicago

IN ORDER to show its customers the possibilities of electrically heated industrial devices and small motor-driven tools and appliances, the Commonwealth Edison Company has placed on exhibition a sample of virtually all of such devices manufactured by thirty different companies in this country. About 1,000 sq.ft. (93 sq.-m.) of retail floor space in the heart of the "loop district" of Chicago was set aside for this purpose, and circuits have been installed so that every tool and device can be demonstrated for the benefit of prospective customers and other interested parties. The exhibits come under the following five general classifications: Motor-driven tools, electrically heated tools and instruments, electrically heated ovens, etc., for industrial processes, electrically heated hotel equipment, and electric heating units. The number and the description of the devices under each heading are given in the accompanying table.

MOTOR-DRIVEN TOOLS AND INDUSTRIAL HEATING DEVICES

Tools	Number of Manufacturers	Number of Types
Motor-Driven Tools:		
Drills	5	22
Hammers	2	6
Compressors	2	4
Buffers	3	12
Grinders	3	14
Polishers	3	14
Blowers	2	10
Exhaust fans	2	4
Sewing-machine motors	2	2
Cloth cutters	1	1
Hand magnets	1	1
Wood routers	1	1
Electrically Heated Tools and Instruments:		
Glue pots, ½ pt. to 5 gal	7	23
Soldering irons	6	18
Branding irons	2	2
Tailors' irons	6	19
Laundry irons	4	15
Burnishing irons	1	1
Hatters' irons	1	2
Shoe irons	1	2
Disk stoves	5	18
Sealing-wax pots	2	2
Hat-flanging bags	1	1
Sterilizers	2	4
Muffle furnaces	1	3
Incubators	2	2
Crucible furnaces	1	3
Tube furnaces	1	2
Thermometers	2	3
Pyrometers	2	4
Control panels, hand-operated	2	2
Control panels, automatic	1	1
Soldering iron furnace	1	1
Metal melting pots	2	3
Linotype pots	2	2
Chocolate warmers	2	2
Can cappers	1	1
Flask heaters	3	4
Water heaters	4	10
Electrically Heated Ovens, Etc., for Industrial Processes:		
Japanning	2	2
Drying ovens	1	1
Oil-tempering baths	1	1
Tempering ovens	1	1
Rivet heaters	1	1
Electric Heating Units:		
Strip	3	5
Bayonet	5	11
Cartridges	1	22
Leaf	2	5
Coil	1	1
Grid	1	3
Disk	2	2
Electrically Heated Hotel Equipment:		
Toasters	2	2
Automatic toasters	1	1
Broilers	2	2
Grills	1	1
Ranges	2	2
Hot plates	1	18
Doughnut stoves	2	2
Bake ovens	2	2
Coffee urns	2	3
Steam tables	1	1
Water urns	2	2
Fry kettles	1	1

The industrial heating exhibit is another step in the process of education and development which the Commonwealth Edison Company has been carrying on for the last seven or eight years. In that time the industrial heating load has been built up to a connected load of more than 50,000 kw. The company's experts have developed many new applications for industrial electric heating and have designed heating elements to meet the particular requirements of different industries. The company tells its customers that if they cannot get standard heating units to do the work they want, the company will suggest modifications in their machines or will design units to meet their requirements.

Intercompany Visits a Success in New England

MEMBERS of the Commercial Section of the New England Section, N. E. L. A., are carrying out a plan of intercompany visits which is working exceedingly well. Different members of the committee have been assigned companies to visit as representatives of the N. E. L. A. in their general localities, and up to date forty such calls have been made. The object of the visits is to promote the interchange of ideas and experiences, with the giving and taking of helpful suggestions along commercial lines.

A central-station man from Portland, Me., for example, is assigned to visit three or four companies in the "Down East" section of the state. Upon arrival he calls upon the manager of the local company and inquires as to various commercial practices which may be in effect, finding out what "the other fellow" is doing, and receiving in turn new impressions and a fresh viewpoint on mutual problems. Free discussion is cultivated, the attitude of employees in one office or another toward the public may be touched upon, constructive comment may be offered as to the efficacy of electric signs used by the company, plans for bettering commercial relations in local districts may be reviewed, and so on. The development of industrial and mercantile lighting, of range campaigns, rates, industrial heating, power-factor matters and many other points may be covered in these visits. In effect, the two or more men taking part in each visit virtually "put through" a miniature convention, short though the time may be for conference. About 120 visits are scheduled before fall.

Nebraska Company Builds Special Line for Farm Service

IN THE construction of a 25-mile, 16,500-volt transmission line recently completed by the Nebraska Gas & Electric Company, Plattsmouth, Neb., to serve the towns of Mynard, Murray, Union and Nehawka, twenty-five farmers were connected along the route. Service to these customers was supplied from a special farm line constructed and financed as an independent item.

Just under the 16,500-volt line, which supplies energy to substations in the towns, is carried a 6,600-volt line of No. 6 aluminum wire to which the farm services are connected. Transformers are either set direct on this line, or if necessary a spur is built to the farmhouse and the transformer installed at the end of this line. Iron wire is generally used for the spur lines which are protected with choke coils and lightning arresters. The cost of the transformer and lightning arrester, in-

cluding their installation, was approximately $150 for each customer served. Transformers and spur lines were paid for direct by the farmers, after which the company assumed their maintenance. The financing of the 6,600-volt trunk line was done by the farmers through their purchase of the company's preferred stock to an amount covering the cost of the line.

A minimum annual guarantee of $60 is required of each customer, and energy is billed at the following rates: Lighting, 15 cents per kilowatt-hour; power, 8 cents; cooking, 4 cents. Average bills have been about $8 per month per customer, although in some cases bills have been as high as $20. It was found that the farmers, as a rule, were willing to make an expenditure up to $1,000 for a spur line and transformer in order to obtain the sevice.

This information was furnished the ELECTRICAL WORLD by J. C. Kuykendall, district manager of the Nebraska Gas & Electric Company, who promoted the financing of the farm line and supervised its construction.

"Learn the Truth" Advertising Aids New Orleans Company

THROUGH a series of advertisements, entitled "Learn the Truth," John S. Bleecker, general manager of the New Orleans Railway & Light Company, succeeded in gaining much popular favor for his company. The "ads" occupied a space of seventy-five lines each and appeared in the same position every day in two of the newspapers of New Orleans. Copy was never repeated—a different story was told each time, and the frank presentation of facts concerning the operating problems and the expenses as compared to the income of the company awakened the public to the fact that an improved public utility service in New Orleans depended largely upon a changed public attitude toward utility corporations.

At the bottom of each "ad," as shown in the accompanying cut, a timely saying or slogan of general interest was carried which added considerably to the effectiveness of the advertising.

LEARN THE TRUTH
Our total revenue for the year ending February first, this year, was $11,443,574.56. Twenty per cent of this amount was spent on improvements. This is the money that ordinarily would have gone to the stockholders. Every owner of stock is sacrificing dividends in order that the service may be made better
New Orleans Railway & Light Company
JOHN S. BLEECKER, General Manager
HELP THE ZOO
LEARN THE TRUTH
5½%
Our net earnings last year in the railways department were 5½% on an investment of $26,000,000. Public Utility Commissions in many states decree that 8% is a fair return. We are spending our 5½% on improvements. The improvements would come faster if the return were larger
New Orleans Railway & Light Company
JOHN S. BLEECKER, General Manager
Plant Flowers
LEARN THE TRUTH
Distribution
For every dollar earned by the Railway Department in 1919, 64c went to operating expenses, 9c to taxes, 6c to renewals and replacements. The other 21c is available for interest on the property.
New Orleans Railway & Light Company
JOHN S. BLEECKER, General Manager
SMILE AWHILE
LEARN THE TRUTH
ADVERTISING
Every penny paid out by the N. O. Ry. & Light Co. for advertising comes from money received from street car advertising, and not from street car, gas or electricity receipts. It is New York money spent in New Orleans.
New Orleans Railway & Light Company
JOHN S. BLEECKER, General Manager
SAVE, BUT DON'T HOARD
LEARN THE TRUTH
GOOD ROADS
We are boosting good roads because good roads lead to good towns. We want New Orleans to grow, because its growth means the growth of our business.
New Orleans Railway & Light Company
JOHN S. BLEECKER, General Manager
PUSH

TYPE OF NEWSPAPER ADVERTISEMENTS USED BY THE NEW ORLEANS RAILWAY & LIGHT COMPANY

Baltimore Company Requires Certificates of Inspection for Connecting New Wiring

THE Consolidated Gas, Electric Light & Power Company of Baltimore, Md., has recently announced to its customers that certificates of inspection will hereafter be required from the National Board of Fire Underwriters before connecting new interior wiring for the use of its service. This announcement was made by Herbert A. Wagner, president of the company, in a circular letter as follows:

For the better protection of electric consumers, and at the request of the Fire Underwriters, we have decided to require their certificate of inspection before connecting new interior wiring for the use of our service. This is now the almost uniform practice throughout the country.

In the matter of eliminating fire hazards the interests of property owners and the insurance companies are practically one, and we feel that we cannot refuse to co-operate in every reasonable way to bring to our consumers and to the people of Baltimore the maximum degree of protection and the fullest safeguards. This inspection will supplement, and will in no way interfere with or displace the inspection afforded by the city building inspector. Even double inspection is not too great a safeguard, and it more than warrants the expense to the property owner, more especially when building operations are being rushed and rapidly increased, as at the present time.

All of our contracts for electric service contain the following provision, which has been approved by the Public Service Commission: "All wiring upon the customers' premises must be installed and maintained in accordance with the requirements of the statutes and the rules of the national and state Board of Fire Underwriters, the rules and regulations of the municipal authorities and those of the company."

Schedules of fees for inspection will be furnished from the office of the electrical department of the Association of Fire Underwriters of Baltimore City. The wiring contractor will be expected to collect the inspection fee as part of the cost of the wiring, and it is suggested, for uniformity in practice, that all your bids for wiring should include the inspection fee as part of the cost.

In accordance with the foregoing we now notify you that Fire Underwriters' inspection certificates will be required as a condition of connection on and after June 1, 1920, on all work contracted for after May 1, 1920.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Standard Carbon Brushes.—L'Union des Syndicats d'Electricité recently adopted a set of standard specifications for carbon brushes used in electrical machinery (excepting traction motor brushes) as a guide for future construction. Four different types of carbon brushes were defined, and standard dimensions of series of successive sizes were agreed upon. These standard brushes are shown on tracings, and tables of dimensions and allowances are also given.—*Revue Générale d'Electricité,* March 20, 1920.

Aluminum in the Electrical Industry.—FRANK BROADBENT.—This article deals with the development of the aluminum industry and its application in electrical manufactures in Germany. In the table given below it is shown that practically the whole of the German aluminum industry was developed during the war:

Country	Pre-War Production	War Increase	Present Productive Capacity
Germany	1,000	39,000	40,000
Austria-Hungary and Switzerland	11,000	14,000	25,000
France	18,000	2,000	20,000
England	7,500	4,500	12,000
Italy	1,000	6,000	7,000
Norway	1,500	14,500	16,000
United States	28,000	45,000	73,000
Total	68,000	125,000	192,000

The production of aluminum in large quantities in Germany was taken up because of the difficulty in obtaining copper. It is claimed that the success attained by the use of aluminum is such that machines and transformers wound with aluminum equal in many respects those made with copper and surpass the latter in strength. This applies more particularly when soldered joints are avoided. It is said that a successful process of copper-plating aluminum has been developed which permits coppering and tinning all terminals with which connection has to be made, thus preventing the heating up of contacts due to oxidation. Welded joints made by means of a suitable flux are said to be as sound and durable as the aluminum conductor itself. The use of aluminum was not confined to small machines. Reference is made to a synchronous converter of 3,800 kva. capacity which is wound throughout with aluminum.—*Beama* (London), March, 1920.

Lamps and Lighting

Intensive Street Lighting.—W. D. A. RYAN.—The author states that a new system in street lighting has been inaugurated, called the "Intensive White Way" and developed for certain Pacific Coast cities, which is rapidly spreading. The features of this system of street lighting are given as follows: (1) The cosmopolitan atmosphere and dignified effects of the standards by day as well as by night; (2) the minimized window reflections on account of the height of the lamps; (3) the intensity of the illumination and the uniformity of distribution on the street and building façades, with emphasis on the corners in both the light and the design of the standards; (4) the readiness with which features of people in the street can be distinguished, particularly in automobiles with the tops up; (5) the brilliancy and sparkle and good simultaneous contrast of the luminous-arc units with the window and sign lighting; (6) the illumination of the building façades and sharpness of the cornice lines against the sky; (7) the increased intensity as compared with the lighting of intersecting streets, clearly marking the main thoroughfare; (8) the golden tone of the glassware, which gave San Francisco's Market Street the name of the "Path of Gold." Several installations of this sort are described by the writer and interesting cost data are given.—*General Electric Review,* May, 1920.

Generation, Transmission and Distribution

High-Tension Insulator Porcelain.—W. D. A. PEASLEE.—Porcelain used in the manufacture of high-tension insulators must meet certain requirements as to mechanical strength, ability to resist sudden changes of temperature, porosity, homogeneity and temperature coefficient of resistivity. The author discusses the possible influence of the Piezo electric effect in the displacement of the very small crystals which make up the porcelain body. This effect may account for the deterioration of seemingly perfect porcelain. The author also points out the possible improvements in the art of porcelain manufacture and predicts important progress in the manufacture of porcelain insulators.—*Journal A. I. E. E.,* May, 1920.

Economic Voltage of Long Transmission Lines.—HENRY H. PLUMB.—The scope of the paper is to present a rapid solution of the economic copper conductor as determined by Kelvin's law, and, using this as a stepping stone, the solution of the economic line voltage is developed. The theory is then extended to conductors other than copper. Capacity and skin effect are purposely ignored in obtaining the approximate solution. It is suggested that these refinements can be applied later. The writer then proceeds to develop charts for the solution of the problem.—*Journal A. I. E. E.,* April, 1920.

Traction

Current Losses from Direct-Current Railway Track Circuits.—GIROUSSE.—An elaboration of the note to French Academy which was referred to in the Digest for March 13. The author now shows in more detail how to establish and solve the system of differential equations relating to track potential and track current for certain of the simpler cases. These equations lead to solutions in terms of hyperbolic sines and cosines,

which permit a determination of current loss from the track circuit. The author also suggests methods for applying the results of this idealized analysis to problems of practice where curves, feeders, etc., complicate matters.—*Revue Générale d'Electricité*, March 20 and 27, 1920.

Installations, Systems and Appliances

Hydro-Electric Development at Ranney's Falls.—This is another development of the Hydro-Electric Power Commission of Ontario on the Trent Canal. The conditions for development are said to be ideal at this site, and two 5,000-hp. units operating under 47-ft. (14-m.) net head are to be installed.—*Canadian Engineer*, May 13, 1920.

The Peak Load Steam Plant in Vasteras.—In a careful translation of an article which appeared some time ago in the *Teknisk Tidskrift, Elektroteknik*, a detailed description is given of the steam generating plant erected at Vasteras, Sweden, by the Swedish Water Power Administration. The plant is designed for a capacity of 40,000 kw. and is intended to supply load peaks and to be used as a reserve for the Trollhättan and Alvkarleby systems during seasons of water-power shortage. So far two units of 5,000 kw. each have been installed, one a Stal and one with an Asea-de Laval turbo-generator. Careful efficiency tests have been made with this equipment, and it was found that at full load the Stal unit required 4.72 kg. steam at 323 deg. C. per kilowatt-hour (10.4 lb.), while the De Laval turbine required 5.55 kg. (12.24 lb.) steam per kilowatt-hour.—*Elektrotechnische Zeitschrift*, Feb. 5, 1920.

Electrophysics and Magnetism

Magnetic Field Around a Submerged Alternating-Current Cable.—LICHTE.—In connection with some work on a ship-guiding system with submerged single-conductor, alternating-current cables, the magnetic field surrounding such a cable was explored at different frequencies. It was found that at low frequencies the field maintains its ordinary form, the lines of force forming concentric circles, but at about 500 cycles or 1,000 cycles an inversion takes place due to induced currents in the water. The maximum response in a coil receiver with telephones decreases exponentially with distance from the cable sending end and also exponentially with the depth of the cable under the water surface.—*Elektrotechnische Zeitschrift*, Jan. 29, 1920.

Electrochemistry and Batteries

A Peculiar Type of Intercrystalline Brittleness of Copper.—HENRY S. RAWDON and S. C. LANGDON.—A copper rod used as cathode in a bath of molten sodium chloride, mild steel being the anode, with an emf. of approximately 6 volts, was made brittle to a very appreciable extent. No such result occurred when the copper was the anode of a similar set-up. The change of microstructure which occurred in the first case suggests that metallic sodium is formed by electrolysis, which alloys with the copper along the boundaries of the crystals and so induces the brittleness observed. The results throw some light upon brittleness of copper wire and rods which sometimes occurs in commercial practice in the annealing in a bath of fused salt if the copper is in contact with iron or a similar metal.—*Technical Paper No. 158, U. S. Bureau of Standards*, April 10, 1920.

Units, Measurements and Instruments

The Corona Voltmeter and the Electric Strength of Air.—J. B. WHITEHEAD and T. ISSHIKI.—An improved form of the corona voltmeter is described. Precision measurements of crest values of high alternating voltage taken in the high-tension circuit are compared with the indications of the corona voltmeter. The law of corona has been determined to a higher degree of accuracy, and a modification in the form of the law as heretofore accepted is revealed. As based on the precision voltage measurements, the corona voltmeter is proposed as a natural secondary standard of high voltages. Its advantages as a standard and its practical operation are described at length by the authors.—*Journal A. I. E. E.*, May, 1920.

Telegraph, Telephone and Signals

Absolute Measurements of Magnetic Field Strength in an Antenna Radiation Field.—RAUSCH VON TRAUBENBERG.—The current induced in a coil of known dimensions (thirty turns, 9 ft. square) and resistance was measured by a vacuum thermocouple, the coil being tuned to a distant station by a series condenser. If smaller field strength than $H = 10^{-6}$ gauss were to be measured, the thermocouple was replaced by a crystal detector with a high-sensitivity galvanometer, and after observing the maximum deflection when receiving the distant station, the same deflection was reproduced by inducing the exploring coil by means of a small coupling coil, fed from an auxiliary triode oscillator. The mutual inductance between the coupling coil and the exploring coil was determined by calculation from the geometry of the system, and, knowing the oscillator current and frequency, the magnetic field vector thus could be computed.—*Jahrbuch der Drahtlosen Tel. und Tel.*, November, 1919.

Multiple-Grid Vacuum Tubes.—SCHOTTKY.—The author discusses the advantages to be derived from inserting in vacuum tubes of the audion type, besides the controlling grid, one or more extra polarizing grids, to be kept at given, positive potentials with respect to the filament. The two-grid tubes may be divided into two classes. Either (1) the polarizing grid is inserted between filament and controlling grid and, being positively charged, serves to neutralize the space charge, thus permitting a high anode current to flow in spite of the strong negative polarization usually employed on the control-grid, or else (2) it is put between grid and plate and serves to screen the electron stream from the fluctuations in plate voltage which are due to the output impedance drop. Voltage amplification values of 20 to 30 appear to be easily obtained in double-grid tubes. The article offers much curve material and other data relating to different types of Siemens & Halske double-grid tubes.—*Archiv für Elektrotechnik*, Dec. 8, 1919.

Miscellaneous

Oil as a fuel from the Producer's Viewpoint.—HENRY THOMAS.—The world's production of petroleum in the year 1918 was 514,208,715 barrels of 42 gal., produced by the following countries in the order of their quantity as reported by the United States Geological Survey: The author discusses the use of petroleum as a fuel and oil burning equipment both for marine and power plant use.—*Journal Engineers' Club of Philadelphia*, February, 1920.

Scientific and Industrial Research

(PRINTED IN THE THIRD ISSUE OF EACH MONTH)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF
Cornell University, Ithaca, N. Y.

Research in Progress or Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

AERIAL, PLATE TYPE.

An investigation has been completed which shows that an advantageous type of radio aërial is a condenser consisting of two large metal plates. This type of aërial has many of the advantages of the coil aërial.—*J. H. Dellinger, Bureau of Standards, Washington, D. C.*

CIRCUIT BREAKER, SUBSTITUTE FOR OIL.

Tests have been made on a 300-amp. oil circuit breaker by short-circuiting a 12,000-volt, 20,000-kva. turbo-generator, at reduced voltages, through a considerable length of cable. With the usual mineral oil the breaker began to show considerable distress at 10,000 volts. The breaker was then equipped with hollow brass tubes in place of the usual solid contact rods, with a venting arrangement at the upper end for relieving gases generated in the arc. The wells were filled with a special liquid, known under the trade name of "S. & C. Excello Liquid," which is a chlorine derivative very much less volatile than carbon tetrachloride. Under these conditions the breaker showed a marked improvement in performance and opened the short circuit at 12,000 volts successfully without showing any distress.—*C. J. Hejda, Commonwealth Edison Company, Chicago, Ill.*

CORONA FORMATION IN GASES OTHER THAN AIR.

An investigation is under way of the critical, or corona-forming, voltages in gases other than air under both continuous and alternating voltages.—*J. B. Whitehead, Johns Hopkins University, Baltimore, Md.*

GLASSES, COLORED, ULTRA-VIOLET, AND VISIBLE TRANSMISSION OF.

During the last three years the spectral transmissions of a great number and variety of glasses have been measured throughout the ultra-violet, visible and infra-red parts of the spectrum. Such data have been collected for a large number of American and imported samples of glass, so that it is possible to compare their relative merits.—*K. S. Gibson, E. P. T. Tyndall, H. J. McNichols, Bureau of Standards, Washington, D. C.*

LEAD, INTERCRYSTALLINE BRITTLENESS OF.

Sheet lead sometimes assumes a very brittle granular form during service, owing to corrosion. An explanation which has been offered by previous investigators for this change in properties is that it is due to an allotropic transformation, the product resulting from the change being analogous to the well-known "gray tin." Contact with an electrolyte, particularly a week acid solution of a lead salt, has been held to be the agency by which the transformation is brought about. Metallographic examination of the granular "allotropic" lead shows that each grain has the characteristic properties of the ordinary form of lead. The intercrystalline cohesion of the grains for one another, however, has been so weakened that the material has a granular appearance. The rate at which the intercrystalline brittleness is brought about is proportional to the amount of impurities and to the concentration of acid in the solution in which the lead is placed. Practically all the impurities which are found in lead are lodged in between the grains. The preferential attack by the corroding agent for these impurities, and perhaps also for the "amorphous intercrystalline cement," accounts for the brittleness produced. Investigation showed that specimens of exceptionally pure lead (99.993%), when immersed for twenty-four days in a neutral solution of lead acetate, became appreciably embrittled by the formation of minute intercrystalline fissures. No evidence of the existence of an allotropic form of lead similar to gray tin could be obtained.—*Henry S. Rawdon, Bureau of Standards, Washington, D. C.*

PHOTOMETER, PHOTOELECTRIC.

Certain difficulties have heretofore prevented the use of photoelectric cells in routine photometry. The use of a thermionic amplifier to increase current readings promises better results, as does also the use of a filter to reduce the proportion of blue light and to render the indications proportional to the photometric value. With such equipment lamps are compared by varying their distances to the cell, until the deflection of the galvanometer is the same as that given by the standard lamp.—*Arthur H. Compton, Research Laboratory, Westinghouse Lamp Company, Bloomfield, N. J.*

Suggestions for Research

ANNEALING, ELECTRIC, OF NON-FERROUS METALS.

Electric annealing of non-ferrous metals has many advantages over the present method of using gas-fired or oil-fired furnaces. With the electric method there is much less oxidation, a better control of temperature, etc. The field has hardly been touched and its importance to both the electrical and other industries can hardly be exaggerated. Annealing may be done electrically in two ways: (1) Using ordinary furnaces electrically heated; (2) heating the material to be annealed by passing an electric current through it. In developing an annealing process, either of the types above mentioned or of any other, the important points to be considered are simplicity and output; that is, the ability to anneal at least as many pounds of metal with a given size of furnace as in the ordinary gas or oil furnace. What is needed first is a good electric annealing method; the cost of electricity will in many cases take care of itself.—*N. S. Diamant, Lockport, N. Y.*

DIATHERMY.

The use of the electric current for raising the temperature of the human body in the treatment of diseases is receiving ever-increasing attention. High-frequency currents are used with success to heat malignant growths so as to coagulate and to destroy the tissue and also to kill certain micro-organisms which thrive at the temperature of the body but cannot live at a few degrees above it. The purely electrical side of the problem involves: (a) generation of suitable currents by means of proper apparatus; (b) study of the resistance, inductance and capacity of the human body, and (c) the mode of propagation of high-frequency currents through the human body. Those interested in this subject should consult medical works and transactions of American and foreign electro-medical societies.—*Editorial Suggestion.*

DIELECTRICS, LEAKY, POTENTIAL DISTRIBUTION IN.

The fundamental problem of determining the potential gradient in a leaky dielectric subjected to a given over-all voltage drop still awaits solution. Plane metallic electrodes are to be assumed normal to the direction of electric displacement within the field. Polarization is not excluded, nor the conduction current, nor the displacement current. After the initial stage of application of potential the medium is of course not homogeneous as regards ionic concentration. The difficulty lies in determining the relation between the concentration gradients and the corresponding potential gradients. While the charge distribution is a function of the potential gradient, the latter is itself a function of the ionic distribution and displacement.—*P. G. Nutting, Westinghouse Research Laboratory, Pittsburgh, Pa.*

DISTRIBUTING LINE, DEAD-ENDING HEAVY FEEDERS.

For dead-ending heavy feeders on moderate-voltage lines (up to 13,000 volts) two or more strain insulators are commonly used in series. The cost of turning a corner with this construction is quite high as compared with supporting the same feeder on the tangent. A more economical and reliable method of dead-ending is desirable.—*Editorial Suggestion.*

FURNACE, ELECTRIC, ELECTRODE JOINTS FOR.

As a carbon electrode is consumed a new length is added on top, connected to the old by a thread joint, somewhat as two metal rods would be connected end to end. The thread being molded out of carbon material sometimes gets loose. The binding material also gets loose, owing to a high temperature and to a periodic tilting of the furnace. An improved type of joint is desired, simple, reliable, and one that would remain mechanically strong and electrically would give a good contact with very large currents.

IGNITION OF AEROPLANE ENGINES.

This is a most promising field for experimental investigation. Owing to the fact that modern engines develop explosion pressures of from 400 lb. to 600 lb. per square inch (28 kg. to 42 kg. per sq.cm.) and a mean effective pressure of 120 lb. to 135 lb. (8.4 kg. to 9.4 kg.) the problem of spark plugs is a difficult one. The insulation must be capable of withstanding the enormous temperatures developed, and the plug must not leak. A slight leak past the insulation for a period of thirty minutes would cause complete failure of the plug. The spark points of the plugs must be maintained at a sufficiently high temperature to prevent an accumulation of carbon on them, and yet their temperature must not be high enough to cause pre-ignition of the combustible charge. This means that the spark points must be maintained within a critical temperature zone. The chief trouble encountered with spark plugs up to date has been that at low engine power the temperature of the spark points is so low that the points rapidly become carbonized and the plug is short-circuited. This carbonizing can be corrected by a better system of lubrication. Heating and expansion of the insulated electrode tends to cause the insulator to fail by cracking or otherwise, and the fact that all good electrical insulators are poor conductors of heat makes it difficult to keep the temperature of the insulator down and to protect it from injury by overheating. References to this subject may be looked up in the *Journal* of the Society of Automotive Engineers under the headings of "Ignition" and "Spark Plugs."—*Bureau of Aircraft Production, War Department, Washington, D. C.*

INSTRUMENTS, MEASURING, BETTER MATERIALS FOR.

Considerable improvement could be achieved in the accuracy and permanency of calibration of measuring instruments by the use of magnet steel of greater coercive force and spring materials having less elastic fatigue.—*H. B. Brooks, Bureau of Standards, Washington, D. C.*

REACTANCES, CURRENT-LIMITING, IN POWER PLANTS.

Some trouble has been experienced with current-limiting reactance coils used in generator leads and between sections of busbars, on account of insufficient mechanical strength. Owing to continuous vibration these choke coils in time become loose, and sometimes the turns get short-circuited. The mechanical strength of the supporting frame must be figured out on the basis of the most severe short circuit possible. An investigation is desired to determine the magnitude and the direction of the mechanical forces under such extreme conditions.—*Editorial Suggestion.*

Books of Technical and Industrial Interest

RADIO ENGINEERING PRINCIPLES. By Henri Lauer and H. L. Brown. New York: McGraw-Hill Book Company, 295 pages, 241 illustrations, 12 plates.

Until the publication of this book few textbooks on radio communication have exactly met the requirements of college courses on the subject. In this book the authors have recognized the weaknesses of former works as general textbooks by avoiding being too elementary, mathematical or theoretical and have covered the principles of new and extensive developments during the war except those which Signal Corps authorities have seen fit to keep secret. Because of the authors' responsibilities in preparing training literature for Signal Corps service during the war they are particularly fitted to discuss the subject. From the outset the authors assume that their readers have a knowledge of general electrical theory, and they start from this point by explaining electrical phenomena in vacuum and matter, the electron theory of matter and the underlying principles of radio communication. Then they consider properties of oscillatory circuits, radiation characteristics of antennas and principles of damped and undamped wave radio-telegraphy. Particular attention is given to the characteristics and use of the three-electrode vacuum tube, which is fortunate, since around this device the present and future of radio science seem to center. Older radio apparatus is treated with sufficient fullness to inform the student on essential principles of radio communication. The description of specific apparatus is avoided and only the principles of operation are dealt with, although the general means of utilizing these principles in practical work are given. The last three chapters are devoted to the principles underlying radio-telephony, directional radio, the loop antenna, elimination of interference and miscellaneous applications of radio such as to airplanes and submarines. Twelve page illustrations of recent apparatus are included, with more than 240 circuit diagrams, details of construction and characteristic curves.

STEAM TURBINES. By James Ambrose Moyer. New York: John Wiley & Sons, Inc. 496 pages, 225 illustrations.

This is the fourth edition of Professor Moyer's book on the subject and not an entirely new discussion of steam turbines. Hence, like some other books which have passed through several stages of revision and amplification, it comes more nearly meeting the needs of student and practicing engineer because the author has had an opportunity to determine and correct the shortcomings of previous editions. It is particularly valuable coming out at this time because there has been such an extensive development of turbines in the last year or two that the old books are relatively behind the times. The author, having been connected with two large turbine manufacturers and having had successful experience as a teacher and director of mechanical studies, is well qualified to present this subject in an effective and authoritative manner. In a relatively small volume are presented results of practical experience that should serve as a useful manual to practicing engineers as well as to students. As distinguished from the three preceding editions, the features of this book are the more extensive discussions on governing and on calculating the strength of disk-type blade wheels. The latest information on gas turbines is also included. For the engineer using steam turbines the chapters on testing and steam-turbine economics will probably be particularly welcome. Just enough mechanics and thermo-dynamics are included to refresh one's memory on those factors which are essential to the design and operation of steam turbines. Instead of discussing the intricacies of blading in the beginning of the book, the more simple problems of nozzle design are presented first. The entropy-total heat chart which accompanies the book should be found more useful than some charts of this character because it is laid out with lines of constant heat instead of constant temperature. Discussions of new turbine applications and chapters on low-pressure turbines and reaction-turbine design are other features.

ELEMENTARY PRINCIPLES OF ELECTRICITY AND MAGNETISM. By John E. Hoyt, Ph.D. Published by the author. 101 pages, 51 illustrations.

This little volume is in no sense a treatise on the subject, but a brief textbook, the outgrowth of the needs of students in an elementary engineering school. It is well adapted for impressing the fundamental ideas of the subject on the student. It is fully equipped with practical problems associated with each division of the subject and very well suited to enforce the principles which have been laid down. It makes no pretence to be wider than this in scope.

Books Received

HOISTING APPARATUS. Bulletin No. 33 in the "Safe Practices" series. National Safety Council, Chicago, Ill.

SILVER. By Benjamin White. London, England: Sir Isaac Pitman & Sons, Ltd. 140 pages, illustrated. Price, $1.

THE ENGINEERING INDEX, 1919. New York: American Society of Mechanical Engineers. 528 pages. Price, $4.

ELECTRICAL MACHINERY. By Terrell Croft. New York: McGraw-Hill Book Company, Inc. 318 pages, 302 illustrations.

THE HOW AND WHY OF RADIO APPARATUS. By H. W. Secor. New York: Experimenter Publishing Company. 160 pages, illustrated. Price, $1.75.

AMERICA'S GREATEST DAM. By William Benjamin West, Massachusetts Institute of Technology. Published by author. 64 pages, illustrated. Price, $1.

COURS PRATIQUE D'ELECTRICITÉ INDUSTRIELLE. By H. Chevallier. Paris and Liege, France: Librairie Polytechnique. 404 pages, 436 illustrations. Price, 24 francs.

SCHOOL OF PRACTICAL ELECTRICITY. Book II. Fundamentals of Continuous Currents of Electricity. By O. Werwath. Milwaukee, Wis.: Electroforce Publishing Company. 134 pages, 90 illustrations.

ROBISON'S MANUAL OF RADIO TELEGRAPHY AND TELEPHONY. By Capt. S. S. Robison, U. S. N., Annapolis, Md.: United States Naval Institute. 308 pages, 144 illustrations.

THROUGHOUT the field in general supply sales have been holding in good volume. The damper on the market is still the reduced stocks from which jobbers are trying to make shipments. Holes in these stocks are being temporarily plugged by the receipt of cars of isolated materials, but these stocks dwindle away rapidly when applied to back orders and a few "rush" new orders.

FREIGHT is moving in better volume than it was a week ago, but it is not yet supplying the manufacturers or the jobbers in any satisfactory way. Steel mills are operating under better conditions and copper is moving in a little larger volume, but a coal shortage is looming up again at the mines.

MUCH attention is being given by jobbers to credits. The undercurrent of feeling is that the peak of buying is off in the non-electrical trades, and this will undoubtedly be reflected in the electrical trade in due time. Consequently jobbers are being urged to consider the advisability of checking over their long-term collection customers with a view to clearing their books of those who are most likely to fall by the wayside in case of a falling off in business.

IN THE electrical construction field there has been a falling off in activity, and in several sections of the country engineers and electricians are not so scarce as they have been.

SHIPMENTS of fans have not been sufficient to carry over the first hot spell of the year without breaking.

EMPHASIS is being placed on the heavy lamp demand this summer. Stocks are not full, and manufacturers have been unable to get lamps away from their factories in sufficient quantities to fill them. Industrial lighting sizes, the smaller type C, are quite short.

STRIKES in New England electrical factories are impeding deliveries of weatherproof wire and copper bars for commutators and threatening to throw thousands of persons out of work by breaking the continuity of production in many lines of apparatus.

A NEW "FUEL clause" has superseded the former "coal clause" in the rate schedules of the Narragansett Electric Lighting Company, Providence, R. I.

THE MUNICIPAL plant at Danvers, Mass., one of the oldest in the country, has shut down and central-station energy is being purchased.

WORK on the Tugaloo River development of the Georgia Railway & Power Company has been halted because of lack of funds, all except thirty workmen being laid off.

ACTIVE participation in the affairs of the Kansas City Railways Company has been assumed by the security holders' protective committee under the chairmanship of Arthur Reynolds. James D. Mortimer, until recently president of the North American Company and its subsidiaries, has been retained to represent the committee.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

RULES governing distribution circuits in rural districts were discussed at a hearing before the Public Utility Commission of Illinois.

AN INCREASE of approximately 20 per cent in lighting and power rates has been embodied in an ordinance of the Seattle City Council affecting the municipal plant. This ordinance has been vetoed by the Mayor but may be passed over his veto.

AN INDUSTRIAL lighting code has been adopted by the Industrial Commission of Ohio. It is based on the code of the Illuminating Engineering Society.

PLANKS of the national Republican platform adopted at Chicago declare for arbitration of strikes on public utilities and condemn the President for not signing the water-power bill.

HIGH praise of the plan of employee representation in force at the Lynn (Mass.) works of the General Electric Company has been expressed by Richard H. Rice, manager of the factory.

ELIHU THOMSON, acting president of the Massachusetts Institute of Technology, in his address to the graduating class defended the patenting of inventions as opposed to their free donation to the public.

PASADENA, Cal., has been authorized by the Railroad Commission of California to absorb the distribution system of the Southern California Edison Company in that city into the municipal system.

ASKING leave to intervene in railroad freight adjustment cases now before the Interstate Commerce Commission, the Consolidated Gas Company of New York points out the interest of public utilities in depreciation charges against railroads affecting transportation.

A COMPLETELY equipped electrical home has been opened for public inspection in San Francisco as a part of the work undertaken by the California Electrical Co-operative Campaign.

NO STATEMENT on the present status of the water-power bill was forthcoming from the White House or the Department of Justice up to Thursday morning. A rumor that the President had finally signed the bill was unconfirmed.

THAT the delivery of coal to Great Lake ports since navigation opened has not covered current requirements and that central stations must turn to the local lignite supply is declared by the North Central Electric Association to be the fuel situation in that geographic section.

ILLINOIS newspapers, at the instigation of the Committee on Public Utility Information, are devoting much space to fair discussion of utility problems.

FIVE amendments to its constitution were adopted by the Illuminating Engineering Society at its annual meeting. Gen. George H. Harries was elected president.

CO-OPERATION between the Society for Electrical Development and the California Electrical Co-operative Campaign is to be promoted.

ALL THE governors of the New England States have been urged to attend a conference at Washington under the leadership of Governor Coolidge of Massachusetts on behalf of increasing the bituminous coal supply.

A READJUSTMENT of its ninety-nine-year contract to deliver 60,000 hp. to St. Louis has been obtained by the Mississippi River Power Company. By this arrangement the company is assured increased income of $2,500,000 from that source from Aug. 1, 1918, to Aug. 1, 1928.

COMPLETION of the merger of Dwight P. Robinson & Company and Westinghouse, Church, Kerr & Company is announced.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Outcome of Water-Power Bill Situation Still in the Dark

A STATEMENT which will set forth the legal situation in which the water-power bill was involved by the Attorney-General is expected daily at the White House. The statement also is expected to contain an explanation of the President's action with reference to this legislation. Hope was held out on both Tuesday and Wednesday of this week that the statement would be issued before night, but no explanation is forthcoming as to the delay.

While the impression exists in some quarters that the President has signed the bill, it is the opinion of employees at the State Department who for many years have been in charge of editing, indexing and promulgating laws that the bill has not been signed. This assumption is based on the fact that it is the invariable custom to enroll the law immediately after its signature.

The Department of Justice declines absolutely to give out any further information with regard to the Attorney-General's informal opinion concerning the signing of bills after the adjournment of a session of Congress. It is expected, however, that his opinion will be made public in its entirety along with the forthcoming statement from the White House.

The President's secretary has been advised of the wave of protest which followed the announcement that the President had withheld his approval of the water-power bill.

North Central Electric Association Finds Use of Lignite Coal Imperative

THE first annual convention of the North Central Electric Association, the first geographic section meeting of the National Electric Light Association, assembled Tuesday, June 15, at the Hotel Radisson in Minneapolis. Tuesday was devoted to registration and the officers' reception and ball. The duty of the public utility operator to take his part in civic affairs because of his position in the community and the necessity of frank and honest dealing with the public were emphasized by Mayor Meyers of Minneapolis in an address of welcome. F. D. Crocker of Minneapolis, president of the association, told briefly the object of the new organization, which comprises the States of Minnesota and North and South Dakota.

The serious phases of the fuel situation were set forth. Delivery of coal since the opening of navigation on the Great Lakes has so far not covered current requirements, and the development and use of the local lignite coal supplies were declared to be a necessity. The financial and labor problems were briefly touched upon. The importance of local financing of light and power utilities because of the money situation and the responsibility on the part of operators to educate the public to a knowledge of utility problems were the features of a paper presented on Wednesday by H. D. Thrall, vice-president Minnesota Loan & Trust Company.

M. H. Aylesworth, executive manager of the National Electric Light Association, outlined the work to be accomplished by the new geographic sections, and F. R. Winders of the Railroad Commission of Wisconsin presented a discussion of rules governing rural service extensions in Wisconsin. The convention sessions extended over Friday, June 18, when the fuel and transportation situation as well as present-day tendencies in electric cooking were discussed. An excursion, with a supper and entertainment on Thursday evening, was a feature of the convention.

Rates of Seattle Municipal System May Be Increased

ON JUNE 1 the Seattle City Council passed an ordinance providing for an increase of approximately 20 per cent in light and power rates for energy furnished by the municipal lighting system. On June 10 Mayor Caldwell vetoed the ordinance, principally because the Council in framing it did not take into consideration recommendations of Superintendent of Lighting J. D. Ross, who believes present rates are adequate. Mr. Ross, however, is not opposed to certain increases. He is of the opinion that better results can be obtained by increasing present commercial rates 20 per cent and eliminating any rate below 1.5 cents per kilowatt-hour. Mr. Ross says that the municipal plant is making an excellent profit on electric cooking and that the rate of 2 cents per kilowatt-hour is about all the business will stand and permit development of this load.

The rate increase as authorized in the vetoed ordinance may be effective without the Mayor's approval. Six votes are required to pass the ordinance over the veto, and the prevailing opinion is that the Council will resort to this action.

Entertainment Program for A. I. E. E. Convention

THE program of entertainment for the White Sulphur Springs (W. Va.) convention of the American Institute of Electrical Engineers, June 29-July 2, has been arranged to include outdoor events on all four days. A golf tournament and a tennis tournament will go on simultaneously each day, beginning at 2:30 p.m., and there will be a baseball game at 3 p.m. on Thursday, July 1. On that day also transportation will be provided to the Kates Mountain Club, where tea will be served. An informal reception and dance will be held in the ballroom of the Greenbrier at 9 p.m. on Tuesday, June 29. On Wednesday evening there will also be dancing

and Prof. Vladimir Karapetoff of Cornell University will give a piano recital, while on Thursday at 8:30 p.m. a ladies' bridge and hearts tournament will take place. Other events will be announced at the convention. Automobile drives can be arranged for at reasonable rates.

The program of the technical sessions of the convention was published in the ELECTRICAL WORLD for May 22, page 1213.

Increased Cost of Money Recognized in Higher Rates Allowed Utility

THIS spring the Newport News & Hampton (Va.) Railway, Gas & Electric Company found itself facing a deficit of $78,000 owing to the increased cost of labor and materials. It required $250,000 for capital expenditures to maintain its standard of service. These facts were laid before the Common Councils of Newport News, Hampton and Phœbus, the three municipalities interested, with a full statement of earnings and values, and the matter was left in the hands of the municipal authorities, the sole suggestion made by the company being that as new capital would probably cost 8 per cent, rates should be fixed with this in mind.

In granting increases to meet the situation the Councils recognized the right of the company to receive 6 per cent on the capital invested in the property prior to 1920 and 8 per cent on capital to be invested thereafter or during the two-year period when the new rates are to be in effect.

Illinois Newspapers According Fair Treatment to Public Utilities

REPRESENTATIVE newspapers throughout Illinois have begun to publish editorials advocating a fair treatment of public utilities as a result of the campaign of education conducted by the Illinois Committee on Public Utility Information. The committee picked out forty-two editorials which were published during a period of about six weeks and had them all printed on one large sheet of news paper, which was distributed to the utilities of the State last week. Only about one-half of the favorable editorials that appeared were reprinted by the committee, and these are in addition to between 3,000 and 4,000 column inches of news items furnished by the committee, which are printed by the newspapers of the State every month.

The Illinois Committee on Public Utility Information has for some time been urging the editors to give their views on public utility questions. When the editors make erroneous statements the committee corrects them in a manner which the editors seem to appreciate.

Heavy Reservations Made for Supply Manufacturers' Convention

WITH all arrangements completed for the convention of the Associated Manufacturers of Electrical Supplies at the Griswold, Eastern Point, New London, Conn., June 28, 29 and 30, requests for reservations have been received in greater number than for conventions of previous years. Many members are planning to arrive on the twenty-sixth, to remain over the next week's holiday. During the session each section will elect its own officers for the coming year.

The first day, June 28, has been set aside for sectional meetings on air circuit breakers, outlet boxes, armored conductor, rigid conduit, non-metallic conduit, wire and cable and weatherproof wire. That evening will be given to the only open meeting for members.

Although on the second day there are scheduled sectional meetings on industrial lighting, heating appliances, fuses, molded insulation, lamp receptacles and sockets, attachment plugs, snap switches and carbon, it is possible that one or more of these may be changed to accommodate the members. The signaling apparatus, knife switch and panelboard and switchboard sections will meet Wednesday in addition, with possible hold-over meetings. An important session will be held by the general standards committee.

I. E. S. Elects Officers and Adopts Constitutional Amendments

ELECTION of the following officers of the Illuminating Engineering Society for the year 1920-1921 was confirmed by the council at the annual meeting of the society on June 11: President, Gen. George H. Harries; vice-presidents, H. F. Wallace, Dr. George A. Crampton, J. J. Kirk; general secretary, Clarence L. Law; treasurer, L. B. Marks; directors, Adolph Hertz, Walton Forstall, Frank S. Price. These officers, together with Past-presidents Samuel E. Doane and G. H. Stickney, will constitute the membership of the council for the ensuing year. The election of the following section chairmen also was confirmed: Dr. Ralph E. Myers, chairman New York Section; N. W. Gifford, chairman New England Section; C. E. Clewell, chairman Philadelphia Section; J. L. Stair, chairman Chicago Section.

The five proposed amendments to the constitution were declared adopted. These amendments were made for the following purposes: (1) To create a new class of members to be known as student members: (2) to lower age limit for associate members from twenty-one to eighteen, clarify provisions for membership application and provide for affiliates in sections and chapters; (3) to increase income of the society to meet rising costs by increasing the annual dues of all classes of members; (4) to provide for increased local representation beyond the more formal sections by the establishment of chapters upon the petition of ten or more members of the society; (5) to make amendments to the constitution effective Oct. 1, instead of twenty days after adoption.

Creation of the class of student members makes it possible for college students to participate in meetings and subscribe to the *Transactions*. Provision for the class of affiliates allows non-members to take part in local meetings, present papers and discussions, act on local committees and contribute to assessments for local dues. Increase in membership dues has been necessitated by the increased cost of conducting the work of the society. The establishment of local chapters will enable the society to cover a much larger territory. Coincident with the adoption of this amendment the council authorized the formation of the San Francisco Bay cities chapter, of which L. E. Voyer is chairman.

The council has authorized the printing of the third edition of the school lighting code and also the publication of a correspondence or extension course on illumination to be sold schools or colleges which can render the proper service to correspondent students.

Edward Caldwell's Thirty Years of Technical Publishing Celebrated

ON TUESDAY evening the business associates of Edward Caldwell, treasurer of the McGraw-Hill Company, publisher of the ELECTRICAL WORLD, and the McGraw-Hill Book Company, tendered him a dinner at the Engineers' Club to commemorate his thirty years of service with these companies. Mr. Caldwell became assistant editor of the ELECTRICAL WORLD on June 15, 1890, at which time Dr. Louis Bell was editor. Mr. Caldwell was graduated from the University of Michigan in 1886 with an A.B. degree and two years later as mechanical engineer from Cornell. He spent the next year with the Sprague Electric Railway & Motor Company, just at the beginning of electric railway development. He worked on the first electric railway in New England at Salem, Mass. The following year he started in the publishing business on the editorial staff of *Modern Light and Heat*, a paper devoted partly to electricity and partly to gas.

For two and a half years Mr. Caldwell was assistant editor on the ELECTRICAL WORLD, and in January, 1893, he went to Chicago as editor of the *Street Railway Gazette*, where he first became associated with James H. McGraw. In June, 1894, he became business manager for the *Street Railway Journal*, now the *Electric Railway Journal*, and he continued in this work until January, 1897, when he became associated with Hugh J. Grant, former Mayor of New York City, in street-car advertising. After a year spent in this work he devoted a year to trade-paper advertising agency work. In January, 1899, he returned to the McGraw Publishing Company and took charge of the book department. At that time the department had to its credit between thirty and thirty-five book titles. In 1909 this department was consolidated with a similar department of the Hill Publishing Company, thereby forming the McGraw-Hill Book Company. Since that time the company, of which Mr. Caldwell is treasurer and director, has grown until it now has more than 1,000 titles on its list.

In September, 1902, *Electrochemical Industry*, the forerunner of *Chemical and Metallurgical Engineering*, was formed in Philadelphia, with the late Dr. E. F. Roeber as editor. Along with his other duties Mr. Caldwell was business manager of this publication in its infancy.

Two years ago Mr. Caldwell became treasurer of the McGraw-Hill Company, at the same time retaining his connection with the book company.

Mr. Caldwell has always kept closely in touch with electrical engineering progress, and for many years has been a member of the American Institute of Electrical Engineers.

New York Edison's Gross Earnings Increase $3,464,069

GROSS earnings of the New York Edison Company for the year ended Dec. 31, 1919, were $28,793,272, an increase of $3,464,069 over 1918, according to its annual report submitted to the Public Service Commission. After the deducting of operating expenses, taxes and other charges the net revenue available for dividends and surplus was $7,246,137, or $2,062,392 more than the year previous.

The increased gross earnings are due largely, it was stated at the office of the company, to new business which has been secured through the closing down of private plants. Labor and fuel costs have made the operation of isolated plants almost prohibitive, and the New York Edison Company now has under construction extensive increases in the capacity of its distribution system in order to serve adequately the volume of additional business.

Dual-Type-Lamp Lighting System Inaugurated at Saratoga Springs

SARATOGA SPRINGS, N. Y., officially inaugurated its new street and park lighting system on June 19, the first installation of its type. It consists of 140 units on Broadway and 53 in Congress Spring Park. Lighting of the main street presented an unusual problem as a high degree of illumination was desired without in any way sacrificing the large trees which line the street. A survey of conditions brought the recommendation of high-candlepower lighting units placed close enough together to produce practically a floodlighting effect.

The main street standards were equipped with two globes, each containing a 1,000-cp. lamp for the principal

THE NEW SYSTEM IN COMPARISON WITH THE OLD

lighting and a 250-cp. lamp directly above it for after-midnight lighting. These units are shifted from high to low candlepower by means of a relay cutout in the fixture casing operated by short-circuiting the transformer at the power station. This change can be made within three seconds and is accomplished without duplication of lighting circuits. The park standards are smaller and have only one 250-cp. lamp each, which burns all night.

The installation, which was designed by W. D'A. Ryan of the General Electric Company was financed by the Adirondack Electric Power Corporation for about $42,000, the city having signed a ten-year contract at $13,000 a year, for which it will receive fifteen times the candlepower and ten times the average illumination that were obtained from the fifteen 600-cp. mast-arm pendent units which had been used formerly to light nearly a mile of the street.

Detroit Edison Company Asks 20 per Cent Increase

THE Detroit Edison Company wants a general increase of nearly 20 per cent in its rates, but before taking the matter up with the Michigan Public Utilities Commission the company notified the Detroit City Council, which discussed the matter on Monday, June 14. While it is understood that the municipality has no jurisdiction in the matter and that the right of regulation rests with the commission, the hearing before the City Council was conducted at the request of Alex Dow, president of the Detroit Edison Company, presumably as a matter of public policy. It is reported that the proposed residential rate increase amounts to 17.8 per cent. The company asks that new rates be made effective on July 1.

Asks 60 per Cent Increase, Gets 10 per Cent

A DIFFERENCE of opinion between the Idaho Power Company and the Idaho Public Utilities Commission over the amount of the increase that the company should have to enable it to meet the conditions of efficient service and attract needed new capital developed when the company's request for a 60 per cent increase on irrigation service was met by the allowance of 10 per cent increase on existing business and 20 to 25 per cent on new irrigation contracts. The 10 per cent raise, moreover, is equivalent only to a discontinuance of the discount all consumers have hitherto been allowed.

The commission declared that "increases in rates, when necessary to enable a utility either to keep its service at the point the public demands or to attract new capital with which to make needed increases, are justified." After hearing testimony for twenty-five days, however, it determined that the rates just mentioned should be enforced for 1920, with such subsequent revision of the price for irrigation pumping as may be found necessary after a general valuation of the company's property shall have been made.

Rural Business to Be Discussed at Iowa Section, N. E. L. A., Convention

THE annual convention of the Iowa Section of the National Electric Light Association will be held at the Colfax Hotel, Colfax, Iowa, on June 23, 24 and 25. Rural business and the conditions affecting all rate, service and public utility questions are the principal subjects to be covered in a very full program which is given in detail below:

Wednesday Morning — President's address; general discussion on the ways in which the association can be made of more value to its member companies.

Wednesday Afternoon — Report of farm-line committee, by John M. Drabelle, Cedar Rapids; "Electric Service from Rural Transmission Lines," by Ceda B. Campbell, Ames; report of industrial interference committee, by John M. Drabelle.

Thursday Morning—"Valuation and Rate of Return," by B. J. Denman, Davenport; general discussion on state versus municipal regulation in Iowa.

Thursday Afternoon—"Determination of Rates for Electric Service," by W. J. Greene, Cedar Rapids; general discussion on fire and liability insurance for public utilities; general discussion on unprofitable and undesirable customers.

Thursday Evening—Banquet; address on the future of the public utility by M. H. Aylesworth, executive manager National Electric Light Association.

Friday Morning — "Customer Ownership of Securities," by E. V. Graham, Middle West Utilities Company, Chicago; general discussion on proposed Iowa committee of public utility information.

Friday Afternoon—Reports of special committees; election of officers.

Arrangements have been made to have a prepared discussion on each item on the program. Following the banquet on Thursday evening there will be a dance.

Merger of Engineering Companies Completed

OFFICIAL announcement has been made of the completion of the merger of Dwight P. Robinson & Company, Inc., and Westinghouse, Church, Kerr & Company, Inc. Officers of the new concern, which was formed in Virginia and bears the name of Dwight P. Robinson & Company, Inc., are: President and chairman of the board, Dwight P. Robinson; first vice-president, T. N. Gilmore; vice-presidents, I. W. McConnell, A. K. Wood, R. M. Henderson, L. H. Bean and H. H. Kerr; secretary, W. L. Murray.

As a result of the merger, Vice-president L. H. Bean stated to a representative of the ELECTRICAL WORLD, the new company has on hand uncompleted contracts amounting to approximately $30,000,000 for the construction of power plants, industrial buildings, transmission lines, fertilizer plants, railroad shops and steel mills.

Pacific Coast Interests to Co-operate with Society for Electrical Development

CLOSER co-operation between the Society for Electrical Development and the California Electrical Co-operative Campaign is expected in the near future, J. M. Wakeman, general manager of the society, stated the other day to a representative of the ELECTRICAL WORLD. Mr. Wakeman recently returned from the N. E. L. A. and jobbers' conventions. During his trip he visited the leading electrical men of the Pacific Coast, who, he said, assured him of their approval of a plan whereby the California Electrical Co-operative Campaign will support the Society for Electrical Development, because of the national character of its work, the value of which the California association has recognized. Plans for this co-operation are now being worked out by the executive committees of both organizations.

Pasadena Authorized to Buy Local Edison System for $533,262

IN AN order issued June 10 by the California Railroad Commission transfer of the electrical distribution system of the Southern California Edison Company in the city of Pasadena to the municipality was authorized for a consideration of $533,262.33. The arrangement by which the city of Pasadena was to remove the chief competitor with its municipal electrical system has been in progress since April, 1918, and since that time Pasadena has bonded itself to provide the money for the purchase of the Edison system. The commission authorized the company and the city to execute the final agreement of sale.

Completely Equipped Electrical Home Opened in San Francisco

A COMPLETELY equipped electrical home has been built and furnished by the California Electrical Co-operative Campaign, the San Francisco Electrical Development League and the Mason-McDuffie Company. It is a modern two-story house and is situated in one of the restricted residence districts of San Francisco. In the home various appliances will be demonstrated under the exact conditions that prevail in the average home.

The formal opening took place on June 11. John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, presided, and the principal address was made by acting Mayor Ralph McLaren. Following the ceremony demonstrations were started of every kind of electrical appliance that can be used in the home. Various days have been set aside for the inspection of the home by architects and home-building societies and by the electrical societies. The house will be open for inspection to the public daily.

Work on Tugaloo River Project Again Halted

LACK of funds to carry on the work of constructing the huge dam across the Tugaloo River at Toccoa, Ga., has caused the Georgia Railway & Power Company to lay off all but thirty of the men who have been engaged in the work. When the company again began work on the project a short time ago several hundred men were transported to Toccoa, and since that time the work has been progressing favorably. On June 5, however, nearly all of the men were laid off, those in charge of the work stating that the company was compelled to take this action because of lack of funds. The thirty men still retained will continue laying the railroad track to Panther Creek, 3 miles from the Tugaloo River. Work on this project had previously been suspended for eighteen months owing to conditions caused by the war.

Employee Representation Plan Praised at Lynn G. E. Works

HIGH praise of the plan of representation employed for the last eighteen months at the Lynn (Mass.) works of the General Electric Company was accorded in an address last week to newly elected representatives of the employees by Richard H. Rice, manager of the Lynn factory. Mr. Rice said that as an instrument of the "square deal" the plan of representation has not only been of immense value since its inception, but that it offers great opportunities for future benefits to both employees and company through its recognition of their mutual interests. The importance of selecting the best men to serve on employee committees was emphasized. The Lynn Works payroll, Mr. Rice said, is now $30,000,000 a year, and even 10 per cent adjustments run heavily into money.

Touching upon immediate problems faced by the management, Mr. Rice pointed out that business is today restricted by the liquidation of merchandise following the calling in of loans by the Federal Reserve banks, by transportation difficulties, underproduction in many plants and the inadequacy of the coal supply. The Lynn works burns 1,000 tons of coal a week, has but three weeks' stock on hand and has but 800 tons in transit. Coal now costs the plant $13 to $14 a ton. The company, realizing the condition of business, is instituting economies and reducing expenditures. The amount of money locked up in raw materials and finished stock is far bigger than ever before.

Republican Party Favors Tribunal to Settle Utility Labor Troubles

WHILE the planks favored by the National Association of Manufacturers failed of inclusion in the platform adopted by the national Republican convention at Chicago last week, that convention adopted several planks of interest to public utilities and the business interests. Chief among these is the following pronouncement on industrial relations:

There are two different conceptions of the relations of capital and labor. The one is contractual, and emphasizes the diversity of interests of employer and employee. The other is that of copartnership in a common task.

We recognize the justice of collective bargaining as a means of promoting good will, establishing closer and more harmonious relations between employer and employee and realizing the true end of industrial justice.

The strike or the lockout as a means of settling industrial disputes inflicts such loss and suffering on the community as to justify government initiative to reduce its frequency and limit its consequences.

We deny the right to strike against the government; but the rights and interests of all government employees must be safeguarded by impartial laws and tribunals.

In public utilities we favor the establishment of an impartial tribunal to make an investigation of the facts and to render a decision to the end that there may be no organized interruption of service necessary to the lives and health and welfare of the people, the decisions of the tribunal to be morally but not legally binding, and an informed public sentiment to be relied on to secure the acceptance. The tribunal, however, should refuse to accept jurisdiction except for the purpose of investigation as long as the public service be interrupted. For public utilities we favor the type of tribunal provided for in the transportation act of 1920.

In private industries we do not advocate the principle of compulsory arbitration, but we favor impartial commissions and better facilities for voluntary mediation, conciliation and arbitration, supplemented by that full publicity which will enlist the influence of an aroused public opinion. The government should take the initiative in inviting the establishment of tribunals or commissions for the purpose of voluntary arbitration and investigation of this issue.

The platform indorses the national budget system, favors investigation of the federal departments and bureaus with a view to their more efficient organization, advocates a simplification of the tax laws, opposes government or employee operation of the railroads, declares for a fair return to the owners of the roads upon their actual value and for favorable working conditions for employees, encourages water transportation, approves the existing laws against monopoly and combinations, pledges an immediate resumption of trade relations with every nation with which the United States is at peace, postpones any consideration of tariff changes until foreign trade assumes a more settled aspect, and insists on a privately owned merchant marine.

On the water-power bill the platform says: "The recent passage of the coal, oil and phosphate leasing bill by a Republican Congress and the enactment of the water-power bill, fashioned in accordance with the same principle, are consistent and landmarks in the development of the conservation of our national resources. We denounce the refusal of the President to sign the water-power bill, passed after ten years of controversy."

Ohio Adopts Industrial Lighting Code

AN INDUSTRIAL lighting code has just been adopted by the Industrial Commission of Ohio as a "guide for inspection" to be used by the factory inspectors of the commission in issuing orders for the improvement of industrial lighting systems. It is expected that the code will be used in this way for about a year before it is given the force of a general law. During this period an educational campaign will be carried on by the safety department of the commission.

This code is based on the Illuminating Engineering Society's code, which it follows quite closely in most of its provisions. It differs from the latter chiefly in having an additional grade of ½ foot-candle minimum for very rough work and in the omission of the rules for emergency lighting and controlling apparatus. There are also several notes intended to make the rules more specific. The appendix is entirely different. Its most notable feature is a list of industrial operations with recommended foot-candles.

With the exception of opposition from a single important industry, practically no objection has been made to the code in its present form. Nine public hearings of one day each were held in six different cities.

Rules for Rural Line Extensions Proposed in Illinois

RULES governing the construction, ownership and maintenance of distribution circuits in rural districts were discussed at a hearing in Chicago before the Public Utility Commission of the State of Illinois on June 10. The proposed rules provide that where rural consumers have formed a corporation for the construction of lines to serve all applicants along the route any public utility must refuse to connect the circuits of the new company until it has obtained a certificate from and filed rates with the commission.

If a mutual organization to furnish consumers without a profit is organized, the utility furnishing the electricity must make certain that the construction installed by the mutual company meets the requirements of the rules for overhead electrical construction.

Should the consumers receive service as individuals the arrangements must be such that the title to the necessary lines and equipment when completed will vest in the electric public utility, which must be responsible for their maintenance and operation. The construction for this class of consumers may be undertaken either by the utility, which must secure a certificate of convenience and necessity, or by the consumers.

Before extending its service into rural territory or connecting to any distribution circuit the utility furnishing energy must file rate schedules with the commission and a statement describing the lines to be constructed, give the proportion of cost to be borne by the consumers, a statement concerning the ownership, maintenance, operation and replacement of the lines and equipment and an explanation of the basis upon which additional consumers will be served.

The proposed rules provide that rates to individual rural consumers shall consist of a service charge and an energy charge, the former to cover the excess cost over town service. Such items of excess cost as maintenance, reading of meters, transformer energy losses, interest, depreciation and maintenance on the increased investment may be considered in the service charge.

Objection to wording of the tentative rules that might be construed as forcing the extension of rural service in territories not now served was raised in the hearing. The testimony pointed out that rates must be such as to make a fair return on the investment if incentive toward the development of rural service was to be provided.

Missouri Supreme Court Sustains Rights of the Cupples Company

JUDGMENT in the suit of the State of Missouri against the Cupples Station Light, Heat & Power Company, brought to determine the right of this company to furnish electrical energy in St. Louis and referred by the October term of the court to Charles G. Revelle as commissioner, has just been handed down by the Supreme Court of Missouri, which sustains the right of the Cupples company to continue to do business and denies the writ of ouster for which application was made. The case was an extremely complicated one involving many disputed matters of fact regarding the franchise of the respondent company. The company's relations to Washington University, which used its conduits free of charge, and the allegation that under the name of the state a private competitor, the Union Electric Light & Power Company, was attacking its right to do business formed important features of the case.

The commissioner found that, while there had not been any direct recognition of the respondent company as a public service corporation by the Municipal Assembly or other legislative bodies, the respondent had since 1913 been recognized by various official acts as being such a corporation by both the Public Service Commission of the State and the City Board of Public Improvements, and his finding in favor of the legality of both the overhead and the underground installations of the Cupples company and also against its forfeiture of rights because of alleged non-use or abandonment was concurred in with slight modification by the court.

Sanford Robinson Favors Valuation at Present Construction Costs

SANFORD ROBINSON of New York City has addressed to the Interstate Commerce Commission a letter in which he withdraws his apparent approval of the idea that in arriving at property valuations "it seems to be a fair thing today to take the prices of 1914 and add the actual expenditures for additions and betterments made since then." The quoted words are attributed to Mr. Robinson in the official report of the commission, but Mr. Robinson asserts that the statement is broader than he intended to make. He states his position on this point as follows:

"No greater weight should be given to the 1914 prices in passing upon the question of the value of an old property than is given to such prices in the case of a new property constructed during the period of higher price level. To make a distinction in this regard between old and new properties would be to distort the relations of value and might lead to different values being assigned to identical properties, dependent upon the time of their construction. It does not seem to me that there is good reason for using a different price base for the property included in the original valuation from that which is used in fixing additions and betterments made subsequent thereto."

National Research Council Elects Officers

OFFICERS of the National Research Council for the year beginning July 1 are announced as follows: Chairman, H. A. Bumstead, professor of physics and director of the Sloane Physical Laboratory, Yale University; first vice-chairman, C. D. Walcott, president of the National Academy of Sciences and secretary of the Smithsonian Institution; second vice-chairman, Gano Dunn, president of the J. G. White Engineering Corporation, New York; third vice-chairman, R. A. Millkan, professor of physics University of Chicago; permanent secretary, Vernon Kellogg, professor of biology Stanford University; treasurer, F. L. Ransome, treasurer of the National Academy of Sciences.

The council, which was organized in 1916, recently received an endowment of $5,000,000 from the Carnegie Corporation, part of which is to be expended for the erection of a suitable building in Washington for the joint use of the council and the National Academy of Sciences. Other gifts have been made to it for the carrying out of specific scientific researches.

Carelessness of Users the Chief Cause of Electrical Fires

THE comprehensive record of fires and their causes which is being prepared each year by the National Board of Fire Underwriters shows, according to a statement by President F. J. T. Stewart to the National Fire Protection Association at the twenty-fourth annual meeting in May, that electricity has caused fires which have resulted in a greater property loss than that due to any other one cause.

"An analysis of these losses," he said, "clearly indicates that this heavy fire loss is due chiefly to carelessness on the part of users of electricity rather than to any fault of the electrical industry or the various authorities which supervise the construction and installation of electrical appliances. It would therefore seem that there is urgent need for a campaign of education to impress upon the public the safeguards which are necessary to be taken in connection with flexible cord, pressing irons and other devices. A creditable effort has already been made by the electrical industry to prepare and circulate leaflets containing well-illustrated descriptions of such precautions, and I should like to urge upon you the importance of extending this educational campaign. Members interested should consult the chairman of our electrical committee."

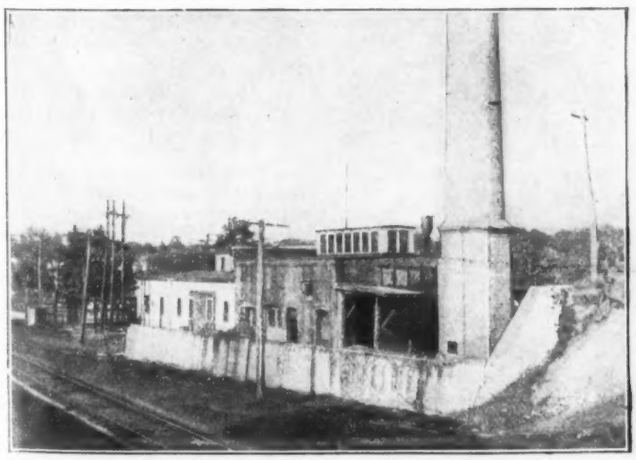
Geological Survey's Figures on Energy Production and Fuel Consumption

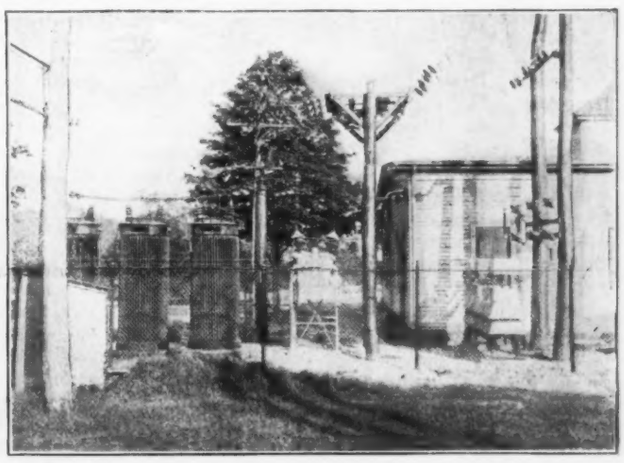
FIGURES for January, February and March, 1920, covering the production of electrical energy and the consumption of fuel by the public utility power plants in the United States have been issued by the United States Geological Survey. These figures are based on returns from about 2,800 power plants rated at 100 kw. or more, including central stations, electric railways and other plants, the capacity of the plants submitting reports being about 90 per cent of the capacity of all plants listed.

According to the Geological Survey's report, the average daily production of electricity during January was 124,600,000 kw.-hr., during February 119,800,000 kw.-hr., and during March 121,800,000 kw.-hr. Of this 33 per cent in January and February and 38 per cent in March was produced by water power. To help produce this energy 10,247,947 tons of coal, 3,481,742 barrels of oil and 4,553,228 cu.ft. of gas were consumed.

A revised curve previously issued by the Geological Survey and indicating the total production of electricity by public utility plants during 1919 shows a total of 38,900,000,000 kw.-hr., or 341,000,000 kw.-hr. more than indicated in the survey published by the ELECTRICAL WORLD for April 3, page 785. As this disparity would just about equal the output of those electric railway power houses not included in the ELECTRICAL WORLD'S figures but forming part of the Geological Survey's, the two compilations are in close agreement.

Thirty-Year-Old Municipal Plant Shut Down





ONE of the oldest municipal plants in the United States, that at Danvers, Mass., established in 1889, has just shut down, and central-station energy is now being purchased. This plant shown on the left, was engine-driven and rated at 1,000 kw. It is replaced by the 23,000-volt, 1,000-kva. outdoor substation in the illustration on the right, to which energy is supplied by the Eastern Massachusetts Electric Company.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Energy Output at Panama. — The total power output at the Gatun hydro-electric station and at the Miraflores plant, Canal Zone, during March was 5,432,790 kw.-hr. Of this output, 12.5 per cent was lost in transmission or in transformation or used in power-plant auxiliaries.

Pacific Gas & Electric Company Acquires More Pit River Rights.—The Mount Shasta Power Corporation, a subsidiary of the Pacific Gas & Electric Company, is to buy the water rights and property of the California Power & Manufacturing Company on Fall River, which is the main tributary of the Pit River and its chief source of water supply. This purchase will make possible the most effective use of the waters of Pit and Fall Rivers and the early development of power on these streams.

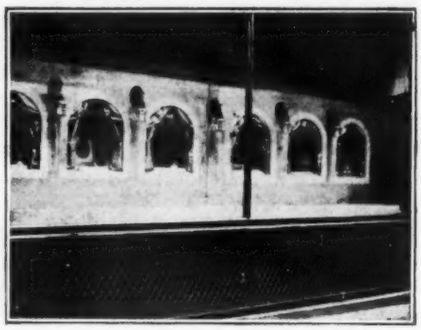
A Well-Put Complaint.—In a petition filed with the City Commission the Sandusky (Ohio) Gas & Electric Company asks permission to advance its rates. The company complains that the prevailing rates were fixed when coal was cheap and that since the price has advanced many industries have found it cheaper to purchase electricity for motive power than to burn coal and have drawn upon the service accordingly. "In other words," said Major C. B. Wilcox, chairman of the board of directors, "we are compelled to buy coal at present prices and generate electricity to be sold at before-the-war prices to consumers who have taken advantage of our predicament to such an extent that anything like good service is impossible."

Spanish Hydro-Electric Companies' Progress.—The capital of the Sociedad Hidroeléctrica Ibérica has been increased from 20,000,000 pesetas ($3,800,000) to 60,000,000 pesetas, of which 15,000,000 pesetas paid-up stock has been issued to the present stockholders. Net profits last year were 2,941,377 pesetas. The Hidroeléctrica Española and other electrical companies have organized the Sociedad de Electrificación Industrial for the electrification of transportation, utilization of water power and manufacture of electrical machinery. A third hydro-electric company has been formed at Madrid for the purpose of constructing and exploiting waterfalls, especially in the center of Spain. Energy up to 15,000 hp. will be transmitted 40 miles at 100,000 volts over the first line constructed as a part of this comprehensive project.

Turin Steel Works Use No Coal.—Electricity derived from water power is now the sole source of lighting and power at the Fiat steel works, Turin, Italy, which consume 15,000 kw. daily, or more than a fourth of the entire consumption of the city. Energy is furnished by the Mont Cenis Hydraulic Power Company.

N. E. L. A. Christmas Literature.—The Commercial Section of the N. E. L. A. has already prepared a booklet and a folder for Christmas trade, attractively printed in colors and designed for distribution by merchandising departments. Two score or more useful gifts are illustrated and many more are listed.

Flasher Lamps Aid Daylight Advertising.—A row of 25-watt lamps mounted in Colonial pattern translucent shades aided greatly in a window display recently made by the S. S. Pierce Company, grocers, Boston. The commodities shown were placed in artistically designed niches behind a cardboard screen run along the window



front. Although the lamps were at the extreme front of the window and were operated on a flasher circuit in broad daylight, they gave life to the display without glare.

Osaka's Four Big Hydro-Electric Projects.—According to *Denkinotomo*, a Tokyo electrical contemporary, Japan has now in contemplation four large hydro-electric developments, intended to relieve the existing shortage of power in Osaka and its vicinity. These projects are (1) that of the Nippon Water Power Company, capital $25,000,000, which proposes to develop 105,000 kw. from the Shokawa River for transmission to Osaka; (2) that of the Nippon Electric Power Company, capital $25,000,000, which has in contemplation the development of a maximum capacity of 102,300 kw. from various rivers for transmission over 212 miles at 125,000 volts; (3) that of the Osaka Electric Transmission Company, capital $10,000,000, to develop from the Kiso River 35,000 kw., to start with, for transmission to Osaka, a possible future total of 350,000 kw. being contemplated, and (4) that of the Taisho Water Power Company, capital $5,000,000, with a total installation of 24,500 kw., for serving Kobe and Osaka over a short transmission line. With the existing supply it is said that Osaka will in the near future have a total installed capacity of 800,000 kw.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Iowa Section, N. E. L. A.—The annual convention of the Iowa Section, N. E. L. A., will be held at Colfax, Iowa, June 23 to 25.

American Society for Testing Materials.—The annual meeting of this society will be held on June 22 to 25 at Asbury Park, N. J. W. D. A. Peaslee will read a paper on testing the porosity of electric porcelain.

Inspection Trip by A. I. and S. E. E.—The Pittsburgh and Cleveland District Sections of the Association of Iron and Steel Electrical Engineers will make their joint inspection trip to the plant of the Trumbull Steel Company, Warren, Ohio, on June 26. "Electric Drives for Steel-Strip Mills" will be the subject of a paper by W. F. Rese and A. W. Mohrman.

New York Electrical Society.—The following officers were elected for the ensuing year at the annual meeting of this society last week: President, W. N. Dickinson; vice-presidents, Ernest W. Muller, Charles E. Speirs, J. M. Buchanan; secretary, George H. Guy; treasurer, Thomas F. Honahan. Mr. Guy's term will be his twenty-third. The society now has 845 members, of whom 182 were elected in the past year.

Empire State Gas and Electric Association.—A meeting of the electric production and electric distribution sections of this association will be held in the Hotel Utica, Utica, N. Y., on Wednesday and Thursday, June 23 and 24. A paper is to be given on hydraulic power-plant records by Frank Howes, one on recent developments in hydro-electric plant equipment, one on the selection of oil circuit breakers, and one on load dispatching. The Trenton Falls plant of the Utica Gas & Electric Company will be visited by the delegates.

New York State Association of Electrical Contractors and Dealers.—The annual convention of this association will be held at the Hotel Utica, Utica, N. Y., on Thursday and Friday, June 24 and 25. Among the papers to be presented are the following: "Effects from the Central Station's Viewpoint of Co-operative Selling Campaigns," by T. E. Steel, vice-president Utica Gas & Electric Company; "Results of Years of Co-operation Between the Central Station and the Contractor-Dealer," by A. A. Anderson, Albany, N. Y.; "Modern Methods of Estimating and Figuring Overhead Costs," by a speaker not yet selected, and papers by H. B. Kirkland and Samuel A. Chase.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Preferential Rates to Sign Maintenance Companies Disapproved.—The Public Service Commission of Missouri has approved the action of the Union Electric Light & Power Company of St. Louis in withdrawing a special schedule of rates made for companies regularly engaged in the rental and maintenance of outdoor electric signs and signboards and requiring such companies to pay standard commercial rates.

Free Service to Employees and Others.—In passing upon a modification of rates for electric service applied for by the Plentywood Electric Company, the Montana Public Service Commission ordered that the rendering of free electric service to employees, whether as part of their remuneration or otherwise, should be discontinued. It did not disapprove of free lighting furnished to a church and parsonage in consideration of a lease for ninety-nine years of the tract of ground upon which the electric plant is built, this contract appearing to be an advantageous one to the utility.

Purpose of Depreciation Fund—Connected Load Charge.—The depreciation reserve established by the Montana Public Service Commission is, as laid down in a recent decision of that commission, intended to take care of the future and not to provide a reimbursement for neglected renewals and maintenance in the past, and replacements and renewals must be charged to the reserve and not to operating expenses. A connected load charge is equitable as a service charge to be paid by the consumer irrespective of the energy consumed and is intended to pay for the depreciation, insurance and taxes on the portion of the equipment devoted exclusively to that particular consumer, the utility taking the risk that the consumer will use sufficient energy to pay operating expenses and return on the investment

California Commission's Stand on Raising Rates.—In granting to the Southern California Edison Company a temporary increase in all its rates of 27 per cent from April 20 until the end of the year, the Railroad Commission of California thus stated its views that a substantial rate increase was a public necessity: "We believe it to be in the interest of the consumers that they pay rates sufficiently reasonable to enable the company to earn a fair and reasonable return upon the actual investment. Unless this is done, it is plain that the utility cannot borrow sufficient funds to carry forward necessary developments. It is of great importance that this program of development go forward. Should there be any halt in this program it is evident that tremendous losses will result to the whole community.

Idaho Commission Asserts Jurisdiction Over Standby Service to Municipal Plant.—The Utah Power & Light Company having applied to the Idaho Public Utilities Commission for authority to enforce its scheduled rate for standby service in the case of the city of Idaho Falls, and that city having resisted the application on the ground that inasmuch as a contract between it and the predecessor of the Utah company antedated the establishment of the commission the latter body had no jurisdiction, the commission has declared that, while it has no jurisdiction over municipal plants as such, it has jurisdiction to fix the rates which a public utility shall charge for standby service rendered to a municipal plant.

Comparative Rates for Merchant and Residence Customers.—While granting increased rates to the Montana Range Power Company, the Public Service Commission of that state criticised the company's initial schedule of charges as being improperly balanced, the residence customer being asked to pay a maximum rate of 12 cents a kilowatt-hour as against a merchants' rate of 6½ cents. "Giving full force to the inherent difference between the two classes of service," the commission said, "no convincing reason is offered for the spread indicated. Owing to early closing precluding consumption by stores of more electricity than residences, to the limited number of merchant consumers and to the extra installation cost of furnishing such service, both services more nearly approach an identical theoretical cost, demanding substantial identity in revenue charge." The commission made a physical valuation of the utility's properties as a basis for a new rate schedule.

Special Rates for Steam Heat Discriminatory.—Special rates for steam heat furnished apartment houses and others by the Pacific Gas & Electric Company and the Great Western Power Company in cases where the steam consumers also use electric power have been declared discriminatory by the California Railroad Commission as the outcome of an application by the companies for an order approving the special rates, and the order has been refused. "Such special contracts," the commission declares, "are the result of active competition. The steam-heating business was apparently entered into for the purpose of extending or retaining electric service by offering at a very low rate steam heat, upon the condition that the consumer would agree to take electric service from the company furnishing the heating service. The commission is faced with the fact that to continue these special contracts would be to permit continuation of discriminatory rates, which are expressly prohibited by the public utilities act."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Responsibility of Employer in Accident.—Liability of a master for the aggravation of an injury to an employee caused by failure of the master to furnish proper medical aid is not recognized by the workmen's compensation act of New York, according to the Supreme Court of that state. (180 N.Y.S. 560.)

Machinery in Power-House Inclosure Not an "Attractive Nuisance."—The Supreme Court of Kansas has held, in passing upon a suit for damages because of the death of a child who entered the power house of a gas and oil company and was killed by the pumping machinery, that in such a case the doctrine of "attractive nuisance" is not applicable, the machinery not having been left unguarded and the negligence, if any, being chargeable to the child's parents. (189 P. 137.)

Facts and Testimony Before Commission Not Subject to Judicial Review.—Facts deduced at a commission hearing are not reviewable and testimony is not to be weighed in court proceedings, according to a finding of the Supreme Court of Michigan. What return a public utility shall be entitled to earn upon its invested capital and what items should be considered as properly going to make up the sum total of that invested capital are questions of fact for the determination of the commission, and its conclusions are unassailable unless it can be affirmatively asserted that the resultant rate is unreasonable and unlawful.

Incorporation Did Not Give Power Company Contract Rights to Lands Included in Development Scheme.—A hydro-electric power company incorporated under Ohio laws did not, the Supreme Court of the United States has decided, by filing its articles of incorporation, specifying the streams across which dams were to be built and maintained, acquire contract rights to have lands embraced in its subsequently adopted plan for the development and sale of power subjected to its use, exclusive of other persons or corporations; and the acts or claims of a traction company whose incorporation antedated plaintiff's incorporation could not be attributed to the state as an impairment of plaintiff's contract rights. The case at issue was that of the Cuyahoga River Power Company vs. the Northern Ohio Traction & Light Company as to rights of eminent domain, in which the United States courts were held by the decision to have no jurisdiction. (40 S. C. R. 404.)

Carl H. Reeves, who has been appointed Superintendent of Public Utilities of Seattle, Wash., by Mayor Hugh M. Caldwell of that city, succeeds Thomas M. Murphine, who resigned following the municipal elections several weeks ago. Since Mayor Caldwell took office the Public Utilities Department has been reorganized and in its place two departments have been formed, one having charge of the Seattle municipal street railway and the other of the electric lighting and other public service works of the city. The latter department, of which Mr. Reeves is superintendent, will have no connection with the railway department. Mr. Reeves has for a number of years been engaged in engineering work in connection with the Seattle traction system and on construction of other city utilities. A resident of Seattle for the past twenty-

C. H. REEVES

seven years, he served in the office of the city engineer for a number of years prior to 1906, and while serving in that capacity designed a large part of the city's sewer system and other municipal projects. From 1906 to 1916 he was assistant engineer of the Seattle Electric Company, resigning to perform special work for the Public Service Commission of the state, after which he took up private practice. During the war Mr. Reeves as major in the Engineers Corps directed engineering work at Camp Fremont, California, at Puget Sound forts, at Camp A. A. Humphreys and at other camps.

Ralph H. Wiley, formerly assistant chief, has been appointed chief of the department of electricity of San Francisco, succeeding Arthur Kempston, who has resigned to become chief engineer of the fire detection department of the Pacific Fire Extinguisher Company.

J. D. Orr has recently been appointed manager of the Idaho Light & Power Company, with headquarters at Pocatello. He succeeds Charles Neely, Mr. Neely having been transferred to Twin Falls as manager in that vicinity. Mr. Orr has served the company as district manager in the Boise territory.

Men of the Industry

Changes in Personnel and Position— Biographical Notes

Arthur F. Barnes, formerly dean of engineering the New Mexico State College, has become associated with Barglebaugh & Whitson, architects and consulting engineers with offices at Dallas, Tex. Mr. Barnes will hold the position of mechanical and industrial engineer and manager for Barglebaugh & Whitson in the district comprising the States of New Mexico and Arizona.

James Martin, district manager of the Pacific Gas & Electric Company, has been appointed superintendent of construction for the company to carry on the work on the Pit River project. He succeeds O. W. Peterson, who resigned the position to become affiliated with the Shattuck Construction Company. This company has the contract for the construction of one of the tunnels on the Caribou development of the Great Western Power Company.

Charles A. Volz has been appointed chief of the division of light, heat and power, New York State Public Service Commission, Second District. Mr. Volz is a graduate of Cornell University, 1911, and has had wide experience with public utility properties. During the world war he served as a first lieutenant with the 302d Engineers, 77th Division, and later as a captain in the engineer officers' training school, Camp Humphreys, Va.

Lieut.-Col. Charles W. Kutz, chairman of the District of Columbia Public Utilities Commission, has been elevated to the rank of colonel of the Engineers' Corps. Colonel Kutz is also engineer commissioner of the District of Columbia.

Obituary

Charles W. Johnson, assistant director of engineering in charge of developments with the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa., who died recently, was graduated from the Ohio State University as an electrical engineer in 1896. He began work in the drafting department of the Steel Motor Company of Johnstown, Pa., and in 1897 became a draftsman with the Bullock Electric Manufacturing Company of Cincinnati, Ohio, advancing to be successively chief draftsman, engineer and production manager. In February, 1904, he was transferred to Montreal, Canada, and made manager of the electrical department of the Canadian Bullock Electric Manufacturing Company. Three years later he joined the Westinghouse Electric & Manufacturing Company at East Pittsburgh and was soon appointed chief inspector. In January, 1910, he was appointed assistant manager of works. In March, 1912, he was made general superintendent, a position he held until 1919, when his chief activities were transferred to the industrial relations of the company with its employees.

Charles Blizard, third vice-president of the Electric Storage Battery Company, died on June 12 after a prolonged illness. Mr. Blizard came to the electrical industry almost thirty years ago, when he was called to straighten out the affairs of the Franklin Accumulator Company in 1891. Here he learned the storage-battery business from the

CHARLES BLIZARD

manufacturing as well as the sales end. In 1893 he joined the Electric Storage Battery Company as manager of the New York office and seven years later became manager of sales for the company, with headquarters in Philadelphia. Later he became third vice-president in charge of sales, which position he held at the time of his death. Mr. Blizard was recognized as among constructive and forward thinkers in the commercial phase of the industry. He had been one of the governors of the Associated Manufacturers of Electrical Supplies since the beginning and for a number of years was chairman of the finance committee of that association.

William J. Rose, who for many years was prominently connected with the electric light and power industry of the State of Ohio, died recently at his home in Alliance, Ohio. Prior to entering the real estate business in 1917, Mr. Rose was treasurer of the Alliance (Ohio) Gas & Power Company. In 1915-16 he was president of the Ohio Electric Light Association.

Harry T. Willett, former secretary of the Springfield (Ill.) Light, Heat & Power Company, died at Decatur, Ill., June 9.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Sales Policy Through Jobber Upheld in Electric Specialty

A RATHER new departure in the sale of an electric specialty is being followed by a prominent manufacturer of electric hand tools, whereby all orders received by the factory direct are turned over to the purchasers' jobber to be filled. Where it may be necessary to fill these orders from the factory, credit is passed to the proper jobber, says the manufacturer. The plan is merely to sell all the factory output through jobbers and not to compete with them through direct factory sales.

This is not a new policy in many lines of supplies carried by electrical supply jobbers, but it is rather an innovation in the case of an electric specialty which has only comparatively recently come into general use and is rather little handled by supply jobbers.

The Black & Decker Manufacturing Company announces the foregoing as its sales policy and furthermore states that it believes the most important thing a manufacturer can do to assist the jobber is to center his efforts on advertising and selling for the jobber. Exclusive selling rights are not granted to any jobber.

Phenomenal Lamp Demand Keeps Summer Stocks Low

LAMP demands have held up surprisingly well for the summer season, while stocks in distributers' hands are in general not up to snuff. Pacific Coast distributers, according to reports, are in a better way than others as regards stocks, and this condition is being watched with a great deal of care, with a view toward possible transfer of surplus to points less favorably situated.

Particular shortage in the East is shown in the smaller type C sizes. This presupposes activity in industrial lighting installations, and it is found that there is a good amount of work being done this summer in that field.

Lamp factories are making shipments, but only in slightly better volume than a few weeks ago. Freight movement of lamps has been given as only about 50 per cent normal. Producers are still unable to get all the materials they require, and, although they are unable to produce in excess of sales, they are not manufacturing for stock. At the present demand and under present receipt of raw products and shipment of finished goods, the outlook for fall stocks is not too bright at this writing.

Stocks of Insulation Materials in General Low

MANUFACTURERS of insulating material report that demand is heavy but not so strong as it should be. Within the past two weeks an appreciable slackening has been noted. This is not taken to indicate a curtailment of new construction work, but rather that buyers of insulation are holding off for possible new developments as regards transportation, prices, etc.

There is no shortage of varnish, but the production of varnished tape, cloth, etc., has suffered from the partial shutdown of the textile mills. Added to this is the freight tie-up, interfering with deliveries. A recent survey of conditions in this field throughout the country reveals the fact that distributers' stocks are very low. Isolated instances occur where dealers are able to fill orders from stock, but this is the result of foresight in buying.

Deliveries vary according to the class of insulation desired. Pressboard, for instance, is quoted at two to three months, while paper insulation requires only two to three weeks. Deliveries of fiber insulation can be made in about six weeks, webbing in two months, and varnished cloth runs from two to four weeks. Deliveries for all these classes of material average double those of normal times.

The tendency of prices has been upward, though for the past two months the market has very generally held steady. No cancellations of orders have been reported.

First Fan Buying Reacts on Already Low Stocks

PRELIMINARY surveys in the fan-motor market show that buying has set in rather late, because of continued cool weather in May and early June. At the same time, stocks are relatively small. This late season has proved rather a life saver than a detriment because it has prevented what might have been an acute situation. Certain distributers throughout the country received fair stocks from their manufacturers quite early in the year, but since the advent of conditions now existing in the transportation field, the movement of fans has been light up to this time.

Early buying has left some distributers with low and broken stocks. In the East the 9-in. alternating-current oscillating fans are having rather a better call than was expected. This may be on account of the cost of larger sizes or because more are being bought for household use. Ceiling fans and 220-volt fans are in good demand.

On the West coast the season has been good and stocks are well cleared out. The Northwest market has, on the other hand, been poor to date. Stocks there are in good condition. Buying has not been active in New England, but there the weather has been cool. Stocks are rather small.

Because of the limited stocks on hand, dealers and distributers are being cautioned to call their prospective customers' attention to the types which can be delivered promptly, in order to satisfy as nearly as possible the demand which is felt really to exist.

Ten-Year Expansion Program in Czecho-Slovakia

THE national assembly of the Czecho-Slovakian republic has appropriated 75,000,000 crowns, at a normal value of 20 cents United States currency, to be expended within the period of the next ten years for "the most complete and perfect utilization of national resources of energy and its economical distribution for the public benefit," according to a report made to the Bureau of Foreign and Domestic Commerce by Vladimir A. Geringer, trade commissioner at Prague, Czecho-Slovakia. It is expected that 6,000,000 tons of coal will be saved thereby. The money is to be used for the erection of hydro-electric power houses and for Government participation in electric plants which would form a substantial part of the systematic electrification of the republic.

Through the law which was passed last July, the Government or the municipality affected, or both, or with an exist-

ing co-operative electric association, will secure public control to the extent of 60 per cent of the capital stock of each enterprise, while private capital can invest only to the extent of 40 per cent of the entire capital stock. This law is considered as a step toward complete nationalization of electric power houses, which, however, to the degree indicated maintains private enterprise. Existing electric concerns can attain the classification of "public utility" and receive the benefits enjoyed by such.

According to the Czecho-Slovakian year book of 1919, the total energy consumed in the republic, excluding railways, was 2,500,000,000 kw.-hr., furnished by 345 electrical concerns selling their product to the general public. Future plans are for systematic electrification, with one distributing network at 22,000 volts to 100,000 volts fed from central stations at coal mines and from hydro-electric stations. It is estimated that the construction of hydro-electric plants will cost about 2,000,000,000 crowns, while steam plants, primary and secondary networks will add 1,500,000,000 crowns. This total construction period would cover twenty years for the steam plants and networks and fifty years for the hydro-electric. In addition, the electric railway would increase this consumption of power considerably.

At the present time, the work is hindered very badly because of the difficulties of getting copper and other installation materials. The domestic production of copper is insignificant, while its purchase in the United States is made hard because of the present rate of exchange.

Business Outlook Warrants Care in Credit Affairs

IT IS hardly possible for business men today to manage the affairs of their business without realizing an undercurrent of feeling throughout the country that there is slack water ahead. Regardless of the individual's feelings in the matter of whether or not there is a coming business depression and whether that depression will be heavy or light, he cannot but feel that the question has been brought up and is constantly recurring.

Let it be said sufficiently often and by men sufficiently in authority in the financial and business world that the buying fever is subsiding and that the pendulum is about ready to swing back and the average business man is liable to take thought as to how he may best protect himself in a coming storm, be it large or small.

The part of setting one's business house in order for what the future may bring was well brought out at a recent meeting of credit men in the electrical industry on the Pacific Coast. There was no attempt at forcing a crisis, but merely the suggestion of seeking out a haven of refuge at the first rumblings of thunder.

It was brought out that before and during the war a great many merchants came into the electrical field who up to that time were unknown. It has not been difficult in the last few years to sell electrical merchandise, and the condition of sale has generally narrowed down to the question of shipment. Correct business methods have frequently been lost sight of in the prosecution of the business, and real competition on a dollars and cents basis has frequently been a missing factor in the transaction. It is foreseen that in a period of depression the return of business on a real price level will again be met and incompetent business will be eliminated from the race.

Few business failures have been reported in the last few years, but a period of business depression, large or small, will most certainly increase this number. Impossible business organizations will undoubtedly die hard and in their dying may help to carry down to destruction many houses which otherwise would weather the storm. The real question comes in segregating those dangerous customers from those which would not be dangerous, and, further, how soon it would be good policy to begin to effect this segregation. The whole matter seems to boil down to getting one's house prepared for an eviction of tenants who, through present and past business methods, give promise of inability to pay bills when they themselves shall be hard pressed for credit and capital. In this case a small house with well-paying boarders seems to be a safer proposition for eventualities than a large house with some questionable tenants.

Some electrical supply jobbers have recently reported that because of extra careful watching of their credits and collections their average of collections has kept up in a satisfactory manner. In the electrical industry it is still a sellers' market, and sellers have great leeway in picking and choosing their customers. Consequently, it would seem that the present would be a good time to exercise still greater watchfulness over present outstanding and possible future indebtedness, with a view toward keeping company assets in as liquid a state as possible. No doubt exists that the time will come when stocks will once more be plentiful on the shelves and price and service will form the consideration in the transaction. That is the time when the house of unsound business methods will be forced to cut prices to a point below the margin of profit in order to move stocks and liquidate as far as possible, and that house will prove no asset on a manufacturer's or jobber's books.

Longer Shipments Ruling in High-Tension Insulator Field

DEMAND for porcelain high-tension insulators continues to rule strong. One representative manufacturer states that he is booked up solidly with orders until January and February and cannot promise deliveries of present orders before then. He further says that the volume of insulator buying on the part of the railroads has greatly increased since the government relinquished its control. Foreign demand is also beginning to make itself felt strongly, coming especially from the Scandinavian peninsula, Italy and France. Producers were looking to the hydro-electric field as a source of demand which would result in heavy orders, but the President's failure to sign the water-power bill has put off the development of this market. Agents report practically no stocks on hand, while manufacturers are from five to seven months behind on orders, compared with normal shipments of from four to six weeks.

An important factor in checking production has been the general shortage of raw material. This is reported as caused by the irregularity of shipments rather than by an actual dearth of sand, clay, etc. In the light of these conditions the general trend of insulator prices has been upward, although since March and April the market has held steady. One of the largest dealers in insulators in the country reports that he is unable to obtain any quotations on the porcelain high-tension types, while another company says it is now able to get quotations for six months ahead but the prices listed are high enough to guard against any fluctuation within that period.

In view of these facts the number of order cancellations has been exceedingly small, a local manufacturers' agent reporting only one cancellation within the past year. This would seem to indicate the continuance of construction programs.

Foreign competition is spoken of in many quarters but is not greatly feared. For one thing, American models of porcelain insulators made rapid strides while European production was at a standstill during the war. These countries have not sufficiently recovered from their industrial chaos to provide sufficient insulators to affect the market very seriously at this time.

Easier Labor Market Seen in Field of Electrical Construction

WITHIN the past few weeks has appeared one of the more tangible signs of a general hesitancy in the building construction field. While real estate interests have been recording rather numerous instances where plans have been filed building operators have experienced a decided falling off in actual operations. Reports show that in the Middle West and in the Middle Atlantic States this decline has been very pronounced as compared with

earlier months of the year. Southern cities and the Pacific Coast and Northwest are just about holding their own, and the one bright spot is shown in New England operations. Here a satisfactory advance is reported. This lessened building activity and retrenchments in the automobile, textile and leather industries have acted to convert a short labor market into one where a surplus may be found.

In the Chicago section, although wages are still as high as ever, it is reported possible to obtain labor whenever needed and, owing to the lessened ease with which a new job may be obtained, employers are able to demand greater efficiency. The Northwest also announces that there is a surplus of labor in that territory.

Representative electrical contractors in the East, who are close to the industrial construction market, say they are having no difficulty in getting sufficient skilled labor to fill all their needs. Helpers are not so plentiful because they are still able to find work at other trades at a slightly higher rate. It has just been brought to notice that one of the larger Eastern electrical engineering and contracting companies is releasing some of its engineers because of a falling off in engineering construction.

These cases are isolated, it is true, but they show a trend toward the easing up of labor in the electrical field. It is possible, however, that with a better flow of building construction material this market may change. Many projects on the boards have been held up, but because of the time-lag by which the electrical industry follows the beginning of construction it is probable that much of this building would not call upon the electrical industry for some months.

Metal Market Situation

BUYING in the copper market remains slack and, because of traffic and coal conditions, hope is not held out of a quick resumption of buying interest. Transportation of raw and refined copper has improved but not to a satisfactory extent. Coal in the copper regions is very low, and in Michigan it is selling at $12 per ton at the copper mines.

Electrolytic price is merely nominal with the producers quoting 19 cents for nearby and third quarter. In the outside market small amounts of the metal can be found as low as 18.25 cents delivered for prompt and July. At that, the call is lacking. August and September shipments are drawing virtually no interest. Standard copper in London is off again, this time to £86 5s.

Leading interests in the lead market reduced prices in New York to 8.25 cents a pound. More spot is available in New York because of export cancellations, but the market is quiet under a fairly good demand.

Zinc producers are offering little of the metal, which is quoted at 7.95 cents at New York, and the outside traders seem to have more inclination to buy than to sell. Buying is being carried on in fair quantities and inquiries are good, even to late year deliveries.

Copper and brass scraps are shown off a fraction and the demand is very light. Lead scrap is holding under a good demand. Tin scraps have reflected the heavy decline in tin occurring over the past two weeks.

NEW YORK METAL MARKET PRICES

	June 9	June 15
Copper	£ s d	£ s d
London, standard spot	90 0 6	86 5 0
	Cents per Pound	Cents per Pound
Prime Lake	18.75	18.50
Electrolytic	19.00	19.00
Casting	17.75	17.62½
Wire base	22.50–23.00	22.50–23.00
Lead, trust price	8.50	8.25
Antimony	8.50–8.75	7.75
Nickel, ingot	43.00	43.00
Sheet zinc, f.o.b. smelter	12.50	12.50
Zinc, spot	8.00	7.95
Tin	48.75	45.50
Aluminum, 98 to 99 per cent	33.00	33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	15.75 to 16.00	15.50 to 15.75
Brass, heavy	9.00 to 10.00	9.00 to 10.00
Brass, light	7.50 to 8.00	7.00 to 7.50
Lead, heavy	7.00 to 7.37½	7.25 to 7.37½
Zinc, old scrap	5.00 to 5.25	5.00 to 5.25

THE WEEK
IN TRADE

SALES of supplies and apparatus are keeping up at a good rate in the East, while in the other sections they seem to have dropped off, owing, probably, to lack of stocks and the tendency to curtail long-term buying. Movement of materials has become better in the past week, but is still far from satisfactory. Strikes in New England brass mills are acting against continued shipment of weatherproof wire and some schedule material parts.

Building activity has been most pronounced in New England and in the South; other districts report a decided falling off in contracts. Building materials are still moving very slowly. Structural steel, however, is gradually being turned out in better quantity. Supply of motors is short in all sections, but contractors are picking up sufficient for most of their immediate needs, although at a considerable expense of time and effort.

Most sections have had sufficiently warm weather to start fan movements, while the hot spell of the early part of this week is expected to provide further impetus to the market.

Few noteworthy price changes have taken place during the week. Collections in general are not falling off in any startling manner because jobbers are using more care in this regard.

NEW YORK

Buying is holding up at a good rate and goods are being received in a little bit better volume. There is no great increase in receipts, but just a general upward trend. The newly formed citizens' transportation committee, for the handling of dock freight by the merchants themselves, has begun to operate and a big tonnage has already left the piers. Promise is held out of still better movement of harbor freight.

Warm weather has started to cut into jobbers' fan stocks, and some styles are already short. Lamp sales are holding very strong for the summer months, and stocks are broken in small type "C" sizes.

Pipe and armored-conductor receipts have been rather small and have been quickly applied on back orders. Motor stocks are in the poorest shape of all apparatus, but of these there are fair quantities of motors for multiple sewing-machine drive. Jobbers have some lamp cord, but manufacturers are quoting twenty to forty weeks' shipments.

Although large commercial building projects are reported almost daily, the general awarding of contracts is falling off. Movement of construction materials is still extremely slow. Collections are holding in pretty fair shape, with no special features this week.

Friction Tape.—Demand is strong and shipments fair, although a slight shortage still exists. Stocks on hand vary. Turnover has increased 50 per cent in the last three months. Prices average 55 cents per lb. in 100-lb. lots.

Rigid Conduit.—Stocks are badly depleted, with almost no shipments in sight. Demand is strong, and jobbers are turning down orders. Prices for ½-in. black pipe range from $86 to $105 per 1,000 ft., and 1-in. black at $168 to $200.

Rubber-Covered Wire.—Shipments are coming in well and jobbers' stocks are good. Demand is strong at prices of $11.50 to $14 per 1,000 ft. for No. 14 in coil lots or over.

Flexible Armored Conductor.—Shortage is being relieved somewhat, although jobbers' stocks are generally low. Shipments are poor and new orders are frequently turned down. Prices range from $105 to $130 per 1,000 ft. in coil lots, depending upon the customer.

Vacuum Cleaners.—Shipments are coming in fair, with deliveries quoted at two months. Jobbers' stocks vary. Demand has slackened since spring but is still strong.

Washing Machines.—Demand is much stronger than in the corresponding period last year and is still on the increase. Shipments are fair, with deliveries averaging two months. Stocks on hand are small, and jobbers are sold ahead.

Motors.—No improvement is seen in distributer's stocks, while demand continues heavy. With considerable hunting contractors are generally able to pick up some kind of a motor to suit their immediate needs. Motors for group sewing-machine drive are in fair though broken stock, while the needle trade is slack.

Insulators.—Demand for glass insulators is strong and stocks are spotty. Some shipments can be made at once, but from there up to four weeks is quoted. Raw-material shortage at the mills is an adverse factor in better shipments. The last price increase was 10 per cent and went into effect May 17.

Industrial Reflectors.—A good demand is experienced this summer, with no slump in sight. Belated shipments have been received in the territory and some stocks are now available. Steel is a little freer at the factory. The 100, 150 and 200-watt sizes are the best sellers.

BOSTON

Jobbers report business better than ever, the principal drawback being unsatisfactory delivery conditions. Considerable improvement has been effected in railroad service, however, within the last two or three weeks. Underproduction by labor is still holding back shipments in many factories, and strikes in the Waterbury (Conn.) and Providence (R. I.) districts are hampering the brass and insulated wire trades. Curtailment of business in the textile and leather industries is having some effect on labor psychology. A strike of molders at the Lynn Works of the General Electric Company is causing some trouble at this writing. Collections are better than many credit men expected would be the case at this time. Stocks are low in rigid conduit, pole-line hardware, motors and weatherproof wire. Prices are firm and steady, barring a 10 per cent advance in fiber conduit. New England building and engineering contracts from June 3 to June 10 totaled $8,826,000, against $5,728,000 last year between the same dates.

Motors.—Famine conditions prevail in small motors. A few odd sizes and speeds can be picked up in the local market, but in general deliveries are quoted on a four to five months' basis. Prices are firm.

Fiber Conduit.—An advance of 10 per cent followed the withdrawal of prices a few days ago by a leading distributer. Stocks are low and demand very active.

Fans.—Buying is sluggish on account of cool weather. Stocks are relatively small. The opinion is expressed in the trade that present prices represent the maximum which can be obtained, but these are likely to hold firm for some weeks.

Rigid Conduit.—Light stocks and broken lines are the rule. A few old orders are coming into town, but no accumulation of smaller sizes is apparently possible.

Sockets.—Trade is brisk, but so far manufacturers have met the demand well. Stocks are fair, with steady prices. In case lots, pulls stand at 50 cents each, net; keys at 28 cents, and keyless at 26 cents. Labor troubles in the brass industry have not seemed to affect the supply of sockets to any extent.

Pole-Line Hardware.—Business is very active and stocks are hard hit. Deliveries are slow.

Wire.—Weatherproof wire is very scarce, some jobbers reporting not a foot in stock. Strike conditions in Rhode Island factories are the explanation. Prices are erratic, base quotations running from 29 to 32 cents. Rubber-covered wire is steady and fairly plentiful at $11.50 per 1,000 ft. in 5,000-ft. lots. Bare copper wire, Boston stock, is quoted at 26.5 cents, with good supplies, notwithstanding factory troubles.

Flexible Armored Conductor.—Liberal stocks are in hand, with prices and demand steady, No. 14 single-strip bringing $110 per 1,000 ft. in 1,000-ft. lots.

Non-Metallic Flexible Conduit.—Shipments are absorbed about as fast as received. The $\frac{7}{16}$-in. size brings $40 per 1,000 ft. in coil lots and $38.50 in 1,000-ft. lots, corresponding prices on $\frac{1}{2}$-in. being $37 and $35.

Meters.—Demand is very heavy, and in some cases house-wiring installations are being given service without meters, subject to estimated monthly bill until deliveries can be made.

Flashlamps.—The demand is increasing, owing to the vacation season and vigorous publicity. Supplies are good at present.

CHICAGO

Chicago jobbers seem to be in worse shape today, as regards stocks and the receiving and shipping of goods, than ever before. Transportation troubles, which for a few weeks showed tendencies to lessen, are now at a worse stage than ever. Railroads are unable to handle more than a small portion of goods offered for shipment, so that, in addition to having stocks seriously depleted by the lack of incoming shipments, it is now impossible to ship out what few items jobbers are still able to supply.

Business remains fairly good in spite of all handicaps. In view of various checks on trade, it is a rather surprising fact that the net amount of unfilled orders on the books of the leading jobbers remained about the same on June 1 as it was on May 1. Each of the preceding months of the year has shown a gain, thus indicating that new orders have fallen off. This reduction is not so pronounced in electrical lines as in other branches of trade, some of which, notably machinery, report a 40 per cent shrinkage in new orders placed. Certain public-utility interests in the Mid-West are showing reluctance about taking orders for new or enlarged service installations.

Unexpected hot weather, coming suddenly on the heels of a cold spring, has boosted retail sales in all manner of household devices, particularly fans. This is reflected in calls on the jobber, and those who were not well protected in stocks are wholly unable to meet the demand. No marked change is noted in the building situation.

Fans.—Demand on the retail trade is very heavy, a prolonged period of midsummer heat being the cause. Most dealers were fairly well stocked but are having difficulty in replenishing stock, as shipments from factory are slow. One jobber reports a consignment on the way for seven weeks, still undelivered. A standard make 12-in. non-oscillating fan is quoted at $28 and a 16-in. fan at $33.

Wire.—As stated last week, all wire stocks are practically exhausted and receipts are apportioned to orders immediately on arrival. While all kinds of wire share in the shortage, it is most seriously felt on magnet wire. No price changes are noted.

Motors.—Several cars of motors have been received in the past week, but the volume of back orders is so great as to make the supply seem inconsequential. Manufacturers in this section are seriously hampered in production by raw material shortages.

Poles.—Some shipments are moving. Leading interests point to subnormal production last winter and abnormal demand this summer as indicating shortage in the coming fall. Supply stocks throughout the country are low, and some substitution is necessary in meeting current demand. Prices are firm, and while no immediate change is anticipated, show a decided upward tendency.

Cross-Arms.—Six-foot, six-pin Washington fir cross-arms, 3¼ in. x 4¼ in., are priced at $123.90 and are in scant supply. The shortage seems to be largely local. Western yards are reported as having quantities on hand for which they are unable to obtain shipping facilities.

Household Appliances.—With stocks of heating devices short in all lines except flat-irons, retail demand has, with the advent of summer weather, become strong. Recent price advances seemingly are having no deterrent effect on trade. Manufacturers' output is being maintained with difficulty, owing to trouble in getting materials.

ATLANTA

Reports from the district indicate that there is a renewal of building activities throughout the Southeastern territory, which is expected to hold up in the face of the shortage of housing facilities and the demand for additional commercial and industrial space.

The strike of the carpenters and plumbers in Atlanta has been called off and construction is being pushed at a maximum rate. Manufacturers report their conditions more favorable than for some time past. The backbone of the railway clerks' strike has been broken and a number of the roads have lifted the embargo on freight shipments. The effects of the strike are still being reflected in the severe congestion that exists at all central points and which has caused a great deal of delay in all classes of freight shipment.

The demand for money is strong, and interest rates are quoted at 6 and 7 per cent. Collections as a whole are satisfactory, though jobbers report customers in the automobile accessory line as slow and the small contractor payments as unsatisfactory, a condition caused in all probability by small operators having overreached themselves the earlier part of the year.

Conduit.—One of the largest jobbers reports nine cars of conduit received for this section in the past week, only one of these cars, however, being for the Atlanta trade. There are no stocks on hand and all receipts are absorbed by back orders. Prices, less than 2,500 lb., ½-in., black, $8.98; ¾-in., black, $11.80; 1-in., black, $17.44. Galvanized: ½-in., $9.40; 1-in., $18.46; 1¼-in. $29.87.

Poles.—The demand is probably the heaviest in recent years, cypress and chestnut poles leading the list. Shipments are fairly good on the poles produced locally, but on the Western product deliveries are unsatisfactory. Price, chestnut, 30-ft., $8.

Safety Switches.—The local ordinance regarding this device has caused an increase in demand of approximately 20 per cent. Very good stocks of assorted sizes are reported on hand and deliveries continue to hold up fairly well. Price, lots less than twenty-five, two-pole, 30-amp., $2.46 each.

Wire.—The wire situation is not so good as was reported several weeks ago, embargo and labor troubles at the manufacturing centers having severely depleted local holdings. A price advance is noted on No. 14 rubber-covered, the market standing at the present time at $12 per 1,000 ft. Jobbers anticipate that local conditions will improve in the next two weeks.

Fuses.—Stock of non-renewable cartridge fuses continue spotty, though renewable fuses are reported on hand in good quantities. Deliveries run from ten days to three months, depending on the sizes desired. Plug fuses are quoted at from eight to ten weeks. Local stocks are in fair shape, with the exception of the 10-amp. sizes. The demand continues good and prices are steady.

Pole-Line Material.—As is usual in the spring, the demand for all classes of line material continues strong. With the exception of porcelain insulators and steel products, local stocks are reported in fair shape with deliveries fairly good. Porcelain insulators are practically unobtainable, and the glass insulators, of which there are fair stocks on hand, are being substituted for porcelain. Pine cross-arms are plentiful, but transportation difficulties have exhausted the supply of fir arms.

SEATTLE-PORTLAND

From the standpoints of both jobber and retailer, the past week has been rather quiet as regards sales volumes, inquiries and actual business transacted. Abundant rain, which assures sufficient moisture for field crops throughout this section, is given as one reason for decreasing sales volumes. Building activity shows a big decrease in spite of the fact that the retail price of lumber and shingles in the Puget Sound and Portland district has taken a drop of between 10 and 20 per cent. The lumber mills of the Northwest are still suffering from car shortage.

At present there is a surplus of labor in the cities, although the agricultural sections east of the mountains in Washington and in Oregon report a scarcity. Stock shortages throughout the entire district still obtain and the freight situation shows no improvement. No price changes of importance have been announced recently, although the general tendency seems to be downward, and some authorities are inclined to the opinion that a noticeable decrease is about due. Collections, generally speaking, are good and credits are being scrutinized more closely than ever.

The Portland district reports general business conditions still of a downward nature, although very little change occurs from week to week. There is a general tightening of credit, and this in turn has a tendency to reduce the purchasing of goods to actual need. Collections are appreciably slower than they have been for months. A few dealers are reporting increased demands for credit, but in general this is not true. Retail stores, however, while reporting business dull for this time of year, also state that it is considerably ahead of last year. The general feeling among both jobbers and retailers is rather pessimistic. Contractors report that there is less business in prospect than there has been for some time and that at present there is no trouble whatever in securing all the skilled labor that is needed.

Metal Molding.—Demand is on the increase and jobbers are having considerable difficulty in meeting the growing needs. Stocks are in poor shape and deliveries range from six weeks to three months.

Conduit.—Stocks are in poor condition, but as the demand is light the situation is not serious. A considerable quantity is in transit with deliveries ranging from two to four months.

Motors.—Fractional-size motors are next to impossible to obtain in face of a good demand. The call for large-size motors and heavy power apparatus is at a minimum. Prices on motors are holding fast; if anything, the tendency is upward.

Fans.—Sales so far this season are almost nil. Movement is always light in the Puget Sound district, but apparently this year will establish new low sales records. There is plenty of stock on hand for anticipated demand.

SAN FRANCISCO

Wiring business has decreased slightly and counter business has decreased appreciably after a period of sharp fluctuation; prices now are fairly steady. United States officials report the lowest levels in mountain streams and lakes on record. The June lake levels are what they normally are in August. However, provisions already made are expected to take care of the irrigation and pumping loads for the rest of the season.

Lamps.—Lamp deliveries are good. Sales, of course, have slowed up during the summer months, and a careful scrutiny of agents' stocks on hand has caused a severe limitation of new shipments to them. Provisions are being made for a heavy sale of Christmas tree outfits.

Fans.—This has been the best fan season for several years. Stocks have been nicely cleaned out, and in some cases even at this late date the dealers' stock orders are being held for Eastern shipments, which have been hurt by freight embargoes. Sales of ceiling fans have been particularly good. Prices seem to cut no figure in the demand.

Household Devices.—The California Electrical Co-operative Campaign, in its annual report, shows a large increase in the sale of household appliances during 1919 over 1918, which was the best of the previous years. Such increases as 138 per cent on vacuum cleaners, 104 per cent for percolators, 100 per cent for toasters, 187 per cent for washers and 137 per cent for ironers speak for themselves. Even the standard appliances such as 6-lb. flatirons with 33 per cent and radiant heaters with 41 per cent show the value of new methods of merchandising.

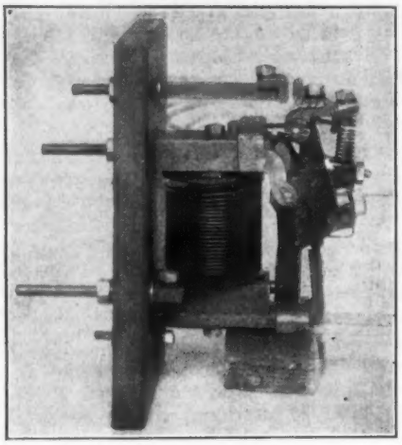
Conduit.—Conduit, both metallic and non-metallic, rigid and flexible, is still one of the scarcest lines, and as yet comparatively small shipments have reached the coast.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Automatic Direct-Current Motor Starter

To control series, shunt-wound and compound-wound direct-current motors, the General Electric Company has developed type CR-4301 automatic motor

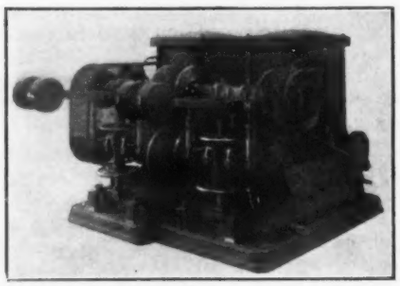


CONTACTOR PARTS ARE MUTUALLY INTERCHANGEABLE

starter. The parts of the various contactors, of which from one to three series accelerating contactors are mounted on a panel, have been standardized so that they are mutually interchangeable, the manufacturer says. A new form of spring adjuster is used. Terminals are provided for energizing extra circuits for pilot lights, etc.

Automatic Spot Welder for Pressed-Steel Channels

To form an I-beam by welding together two pressed-steel channels, the Federal Machine & Welder Company, Warren, Ohio, has developed an automatic spot welder. Two spots at a



WELDS TWO SPOTS IN ¼-IN. MATERIAL

time may be made in two pieces of ¼-in. material at the rate of sixty welds per minute, the manufacturer says. The two welding transformers are for 220 volts primary, are air cooled, and the current is controlled in eight equal steps from 65 per cent to full line voltage. Parts carrying welding circuit are water cooled. The copper-welding disks can be adjusted to weld I-beams from 4 in. to 16 in., and welds can be made from 4-in. to 12-in. centers. A variable-speed motor controls the speed of material through the machine from 25 ft. to 60 ft. per minute.

Electric Script-Letter Sign

The Indestructible Sign Company, Columbus, Ohio, is offering a new style of electric script-letter sign, consisting of an iron oblong box 18 in. x 48 in., within which all wiring is concealed and on both faces of which are the letters. These are drilled into the box in polished aluminum. The sign weighs about 150 lb.

Extension Light

For use where a portable electric light is necessary, the Wood-Craft Company, St. Paul, Minn., is marketing

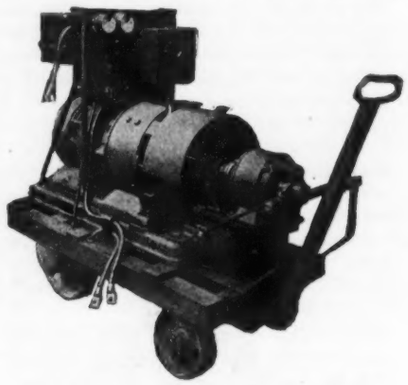
PORTABLE HAND LIGHT

an extension light with 25 ft. of 16-gage reinforced waterproof cord on a reel, equipped with socket, switch, etc.

Single-Operator Electric Welding Outfit

In the single-operator electric arc-welding equipment manufactured by the Westinghouse Electric & Manufacturing Company the generator operates at arc voltage and no resistance is used in circuit with the arc. The generator is designed to stabilize the arc inherently, has a rated capacity of 175 amp. and is the company's standard design and construction, provided with commutating poles and an exceptionally long commutator. There are twenty-one steps provided from 50 amp. to 225 amp. Motors can be supplied for either direct-current or alternating-current circuits. Where an alternating-current motor is used leads are brought outside the motor frame for connecting for either 220-volt or 440-volt circuits. Ball bearings are used on the single-operator motor-generator set.

Where the equipment is required for portable service the motor-generator set with the control panel is mounted on a fabricated steel truck equipped with roller bearing wheels. Motor genera-



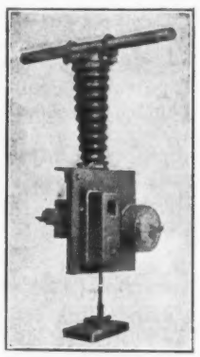
NO RESISTANCE IS USED IN CIRCUIT WITH ARC

tors are supplied in capacities of 300, 500, 750 and 1,000 amp.

The generator is compound-wound to deliver 60 volts at no load and also at full load.

Overload Relays for High-Voltage Alternating-Current Circuits

For the protection of high-voltage alternating-current circuits of 100 amp. or less the Westinghouse Electric & Manufacturing Company has developed the type CB overload relay, which precludes the use of high-voltage current transformers. With this device ample overload protection is obtained and an approximate time element afforded at a minimum cost, according to the manu-



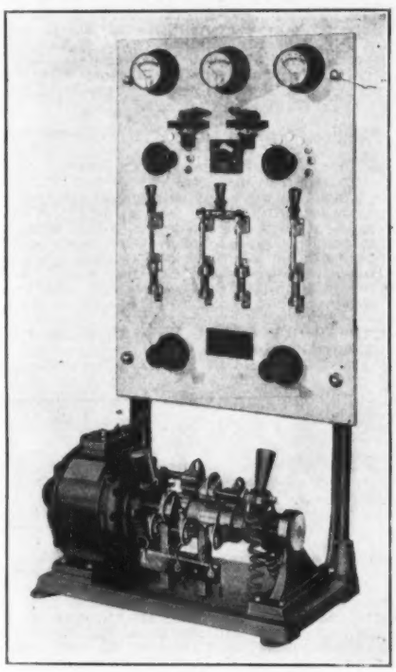
ARRANGED FOR PIPE MOUNTING FOR INDOOR USE

facturer. The relay is designed for indoor use and is arranged for pipe mounting. It consists of a circuit-closing element operated by means of a

standard current transformer, an overload relay and a special transfer relay, all mounted on one base, which is in turn supported from an insulator. The overload relay has a 4-amp. to 12-amp. range and a two-second inverse-definite-minimum-time limit. The current transformer, it is said, can be used on all voltages, since it is thoroughly insulated from ground and from the remainder of the system.

Motor Rectifier for Battery Charging

The Advance Electric Company, 131 East Sixth Street, Los Angeles, Cal., is producing a motor rectifier for storage-battery charging. The set consists of a ½-hp. special-type motor with extended shaft upon which are mounted three collector rings and two special commutators. The motor acts only to drive the shaft, says the manufacturer, and the alternating current



TWO KILOWATTS DELIVERED ON TWO CIRCUITS

is converted into direct current in two separately controlled circuits, in graduated voltages of 22-volt steps to 110 volts and normal capacity of 10 amp. per circuit. The switchboard is of marble and carries the necessary switches, meters, automatic cut-outs, regulators and transformer.

Bank Protection System

In announcing the development of its new "Faraday" bank protection system, Stanley & Patterson, West and Hubert Streets, New York City, point out that every piece of the apparatus—circuit wiring, connections, etc.—is electrically supervised at all times by a flow of current, and that derangement of circuit wiring will instantly sound a trouble bell. In addition, "telltale" lamps may be installed in any of the offices. All alarm signals are operated by a control cabinet.

Variable Wireless Condenser

The Connecticut Telephone & Electric Company, Meriden, Conn., is producing a variable condenser for wireless work, for which compactness, stability and simplicity of design are claimed. Two metal plates of 0.17 sq.cm. area, one of which is movable to and from the other without rotation, are separated by a mica sheet, so that a capacity of 700 micro-microfarads is obtained. The capacity is distributed over a scale length of 360 deg., and the manufacturer says that smooth variation may be had to the extreme end of the scale. The instrument measures 2⅞ in. in diameter and is 1⅜ in. in height to the dial plate. Effective resistance is given as a few tenths of an ohm.

Lineman's Test Set

Without opening the circuit, it is claimed, locations of grounds and other forms of trouble may be made by the Anderson portable lineman's test set, marketed by the West Manufacturing Company, Abilene, Kansas. A combination telephone and test set is used, in addition to a flashlight battery.

Electric Dishwasher

An improved model of the Mermaid electric dishwasher is announced by the Wolcott Manufacturing Company,

NEW FLAT TOP WASHER

Hartford, Conn. The new design embodies improvements in gearing and motor suspension, a slicing castor, table-top cover and other small refinements.

Notes on Recent Appliances

Washing Machine

An electric clothes washer with revolving and tilting container has been developed by the Little Giant Washing Machine Company, Indianapolis, Ind.

Electric Table Stove

The Redtop Electric Company, Inc., 8 West Nineteenth Street, New York City, has placed on the market a combined toasting and cooking stove.

Clothes Washer

A clothes washer of the vacuum-cup type is being made by the Wash-Kosh Manufacturing Company, Oshkosh, Wis.

Interconnection Cable Box

An interconnection cable box for annunciator systems has been developed by the Auth Electrical Specialty Company, 422 East Fifty-third Street, New York City.

Unit Dry Battery

The French Battery & Carbon Company, Madison, Wis., is marketing a four-dry-cell unit in a single casing.

Waterproof Portable Light

Two types of portable lamps for marine use are being manufactured by Charles Cory & Son, Inc., Hudson Street, New York City.

Ground Clamp

Improvement has been made in the ground clamp manufactured by the H. B. Sherman Manufacturing Company, Battle Creek, Mich.

Washing Machine

A washing machine, the Berkshire, with electrically operated pump, has been developed by the Pittsfield Machine & Tool Company, Pittsfield, Mass.

Stair-Routing Machine

The American Router & Manufacturing Company, Ligonier, Pa., has developed an electric stair-routing machine.

Ignition Trouble Finder

For locating ignition faults, the Testall Electric Manufacturing Company, San Antonio, Tex., has developed a trouble finder.

Buzzer

A two-cell dry-battery buzzer is being made by the Electric Signal Manufacturing Company, Inc., Orange, N. J.

Double Busbar Support

A new type of double busbar support has been manufactured by the Delta-Star Electric Company, 2433 Fulton Street, Chicago.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

THE BUDA COMPANY, Harvey, Ill., announces the appointment of H. M. Sloan as treasurer, which became effective June 1. He was formerly assistant to the president of the Chicago, Milwaukee & St. Paul Railway, and also served upon the War Industries Board during the war.

NEIL CURRIE, Jr., has been appointed engineer of the power motor engineering department, Pittsfield (Mass.) works, General Electric Company, succeeding J. P. Catlin, who has been appointed managing engineer, motor division, Bridgeport (Conn.) factory of the company. Mr. Currie has been assistant engineer of the department and has been associated with the latter since 1910.

THE ADVANCE ELECTRIC COMPANY, 6315 Maple Avenue, St. Louis, Mo., will soon ask for bids for the construction of a one-story addition to its works, 50 ft. x 100 ft., to cost about $100,000.

THE ELECTRIC HAMMER CORPORATION has been organized with a capital stock of $1,000,000 to take over the business and property of the Reciprocating Electric Tool Company, St. Louis, Mo. James K. Jarvis is president.

THE STANDARD BATTERY MANUFACTURING COMPANY, Fort Worth, Tex., contemplates building an addition to its plant to double the present capacity.

THE BAYER STEAM SOOT BLOWER COMPANY, St. Louis, has recently completed its new plant at 4067 Park Avenue, to provide for the increasing business in soot blowers, as well as the business of its subsidiary companies, the Bayer Valve Company and the Bayer Brass Foundries Company. The main machine shop building is 200 ft. x 120 ft., and the foundry building is 175 ft. long, the latter providing space for thirty molders on brass and aluminum castings.

W. J. JEANDRON, sole selling agent for the "Le Carbone" carbon brushes, has been in France for the past month visiting the factory in order to obtain a larger supply of carbon brushes to care for the great increase in demand that is expected in this field.

THE NEW ENGLAND MACHINE & ELECTRIC COMPANY, Pawtucket, R. I., has had plans prepared for the erection of a manufacturing plant.

EDWARD MILLER & COMPANY, Meriden, Conn., manufacturers of lamps, heaters, etc., are planning to erect a five story addition to their plant.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY is making further expansions to its East Springfield (Mass.) plant to meet the demand for small motors for washing machines and automobile starting and lighting apparatus. A new punching shop is being equipped with direct-connected motor-driven tools, and a machine shop is under construction for the production of starting and lighting sets. It is expected that the branch of the engineering department which has charge of the designing and application of electrical equipment for automobiles will be transferred to Springfield soon.

THE BARDEN ELECTRIC & MACHINERY COMPANY, Houston, Tex., has recently added two men to its sales department.

DOUGLAS SPRAGUE and CHESTER A. SLOCUM, associate consulting engineers, announce the opening of offices at 167 West Thirteenth Street, New York City.

THE CENTRAL ELECTRIC & LOCK COMPANY, 12 North Thirteenth Street, Philadelphia, is preparing to remove its plant to 1309 Arch Street, where it has recently acquired a building.

THE UNITED STATES HARDWARE & MANUFACTURING COMPANY, Pawtucket, R. I., recently organized, will manufacture insulator brackets and break arms for the electrical trade and miscellaneous products for the plumbing trade. John D. Sawyer is president and general manager of the company.

THE LOCOMOTIVE ELECTRIC WASHING MACHINE COMPANY, Belleville, Ill., has been organized to take over the plant and property of the Remmert Manufacturing Company, Belleville. William Remmert has severed his connection with the company. A. H. L. Klimme is secretary of the new company.

RAUCH & LANG, INC., Chicopee Falls, Mass., recently incorporated to take over the Baker, Rauch & Lang Company, Cleveland, Ohio, will soon start work on its proposed new manufacturing plant at Chicopee Falls.

THE LEEDS & NORTHRUP COMPANY, 4901 Stenton Avenue, Philadelphia, has acquired a site on Germantown Avenue, near Wayne Junction, for its proposed new works.

THE ELECTRIC STORAGE BATTERY COMPANY, Nineteenth Street and Allegheny Avenue, Philadelphia, has filed plans for a two-story addition to its plant, 82 ft. x 160 ft., to cost with equipment about $125,000.

THE PITTSBURGH GAGE & SUPPLY COMPANY, Thirtieth Street and Liberty Avenue, Pittsburgh, Pa., manufacturer of electrically operated washing machines, has started work on construction of a building, 64 ft. x 105 ft., one-story, at 3026 Liberty Avenue, to cost about $50,000.

THE WESTINGHOUSE LAMP COMPANY, 165 Boadway, New York City, has purchased a site at East St. Clair and East Michigan Streets, Indianapolis, Ind., on which it will erect a plant for the manufacture of electric incandescent lamps, to be a duplicate of the one at Trenton, N. J. The building will be four stories high and will have a daily capacity of from 50,000 to 70,000 lamps.

THE ELECTRIC STORAGE BATTERY COMPANY, Allegheny Avenue and Nineteenth Street, Philadelphia, has removed its Cleveland offices from 1217 Citizens' Building to Chester Avenue and East Twenty-fourth Street. H. F. Sauer is acting manager of the Cleveland office.

THE HANSON & VAN WINKLE COMPANY, 269 Oliver Street, Newark, N. J., manufacturer of generators, motors, spare parts, etc., is planning extensions and improvements to its plant, to cost about $14,500.

THE AMERICOLITE COMPANY, 101 Park Avenue, New York City, manufacturer of lighting fixtures, lamp reflectors, etc., has purchased the property of the Standard Steel Box Company, near Bridgeville, Pa., for its proposed new plant. The factory, it is understood, will be equipped at once, and operations will be started at an early date.

THE SUNNY HOME ELECTRIC COMPANY, 1469 East Grand Boulevard, Detroit, has filed plans for the erection of a one-story machine shop, 78 ft. x 160 ft., on Scotton Avenue.

THE COMMERCIAL WELDING COMPANY, Seattle, Wash., contemplates the construction of a new welding and repair plant in the near future.

THE JOHNSON ELECTRIC WASHER COMPANY, 2074 Market Street, San Francisco, has awarded contract for the erection of a factory building at Fortieth and Adeline Streets, Emeryville, Cal., to cost about $40,000.

THE GAS ENGINE & ELECTRIC COMPANY, Charleston, S. C., has filed notice of an increase in capital stock from $50,000 to $100,000 for general business expansion.

THE BRYANT ELECTRIC COMPANY, Bridgeport, Conn., has awarded contracts for construction of an addition to its factory, 60 ft. x 130 ft., four stories, to cost about $125,000, and for a four-story storehouse, 60 ft. x 160 ft., with an ell, 60 ft. x 66 ft., to be erected on Organ Street, to cost about $200,000.

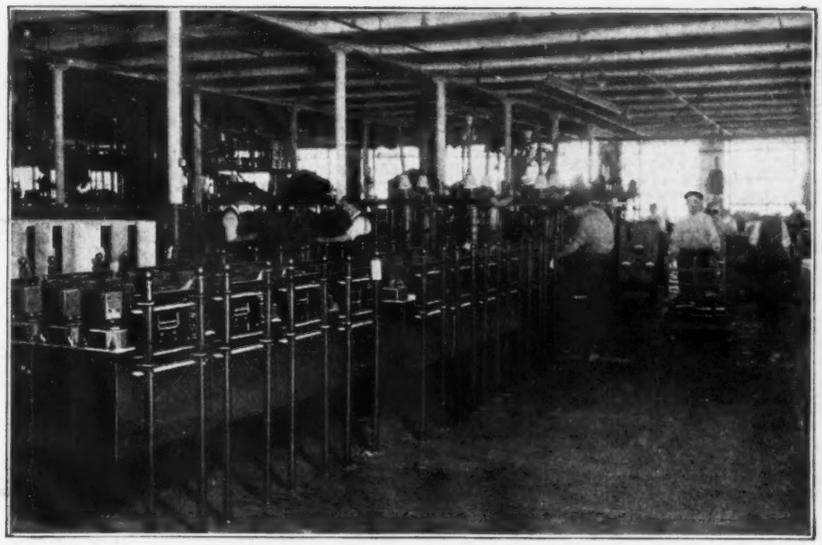
THE DRIVER-HARRIS COMPANY, Harrison, N. J., manufacturer of electrical resistance wires, special metal alloys and pure metals for electrical work, is offering a new issue of $750,000 in 7 per cent cumulative sinking fund preferred stock. Of the new issue $250,000 has been reserved for employees and stockholders.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., is preparing to install machinery at its plant on Columbia Avenue, Baltimore, Md., recently acquired from the United States government. While the present buildings will be utilized for the present, it is proposed at a later date to rebuild and remodel the existing structures. Switches and electric controlling devices will be manufactured at this plant, and when operating at full capacity it will give employment to about 4,000 operatives.

THE WIRT COMPANY announces that it is now established in its new two-story factory and offices at 5221-27 Green Street, Germantown, Philadelphia.

THE ELECTRICAL CREDIT ASSOCIATION of the Pacific Coast held its fifteenth annual meeting and dinner in San Francisco on April 15. R. J. Holterman, manager of the Holabird Electrical Company, was elected president. The retiring president, H. J. Zweifel, presided during the business session, which consisted of reports from the auditing committee, a report of the secretary-treasurer and one from the nominating committee. The toastmaster, A. H. Elliot, introduced the following speakers: L. J. Brown, assistant sales manager Western Electric Company; R. J. Holterman; C. W. Banta, vice-president Wells-Fargo Nevada National Bank; C. E. Listenwalter, Listenwalter & Gough, Inc., Los Angeles, and F. P. Vose, secretary National Credit Association. A spirit of optimism pervaded this meeting, which concluded the eighteenth year of the existence of the association.

PACIFIC COAST ELECTRICAL CREDIT ASSOCIATION'S FIFTEENTH ANNUAL DINNER



SECTION OF ASSEMBLY OF OIL CIRCUIT BREAKERS, CONDIT ELECTRICAL MANUFACTURING COMPANY

THE CHASE-SHAWMUT COMPANY CHANGES HANDS.—Stone & Webster have sold the controlling interest in the Chase-Shawmut Company, Newburyport, Mass., to Sears B. Condit, Jr., of Boston, Mass., president of the Condit Electrical Manufacturing Company, who will operate the concern independently of his other business interests.

THE INGERSOLL-RAND COMPANY OF ILLINOIS and A. S. Cameron Steam Pump Works, Chicago branch, announce the removal of their offices to 709 Fisher Building, Chicago, Ill.

THE FRANKLIN ELECTRIC COMPANY, Hartford, Conn., manufacturer of electrical products, has filed notice of dissolution.

THE CONNECTICUT ELECTRIC MANUFACTURING COMPANY, Bridgeport, Conn., has started operations at the former plant of the Standard China Works, Prospect and Globe Streets, Trenton, N. J., for the manufacture of electrical porcelain specialties. The new works will be conducted by a subsidiary organization, to be known as the Connecticut Porcelain Company. It is proposed to develop an aggregate capacity of about 350 barrels of material a week.

WILLIAM G. MEROWIT, application engineer, has removed his operating quarters to 707 Ellicott Square, Buffalo, N. Y. He is representing the Monitor Controller Company, Baltimore, Md., and the Union Electric Manufacturing Company, Milwaukee, Wis., in western New York and nearby Canada.

THE WORTHINGTON PUMP & MACHINERY CORPORATION, 115 Broadway, New York City, has entered the field of ship engine-room equipment and will manufacture marine engines, pumps, air compressors and auxiliary oil engines generating electricity for all ship purposes.

THE LINCOLN ELECTRIC COMPANY, Cleveland, Ohio, wishes to correct a misunderstanding which may arise regarding its sales policy with the Fairbanks Company, in connection with the distribution of Lincoln motors by the latter company, as mentioned in these columns on Jan. 24, 1920. A. F. Davis, sales manager of the Lincoln Electric Company, announces that in the contract recently signed with the Fairbanks Company the latter will act for the Lincoln company as general jobbers. The Lincoln Electric Company retains, however, the right in any case to sell direct, and also to handle the sale of all motors to the manufacturers of motor-driven machinery, this latter classification being withheld absolutely from the Fairbanks Company.

THE HABIRSHAW ELECTRIC CABLE COMPANY, New York City, has declared a quarterly dividend of 37½ per cent per share on the outstanding stock of no par value, payable July 1.

WILLIAM R. MARSHALL has been appointed manager of the industrial division, New York office of the Westinghouse Electric & Manufacturing Company, to succeed Harlan A. Pratt, who has resigned to become sales manager of the Atlantic Elevator Company, New York. Mr. Marshall was graduated from the North Carolina Agricultural and Mechanical College in 1909 and entered the graduate students' course at the East Pittsburgh works of the Westinghouse company, where he remained for two years studying shop and erection problems. In 1911 he was transferred to the New York office as salesman in the power division.

THE TECHNICAL ADVISORY CORPORATION has recently been organized, with headquarters at 132 Nassau Street, New York City, by Campbell Scott, president; Ernest P. Goodrich, William D. Ennis, Walter Rautenstrauch, Arthur W. Hixson, Fred E. Rogers and Rumsey W. Scott, all of New York City; Col. Frank B. Maltby, Philadelphia, and George B. Frankforter, Minneapolis, Minn., all of whom were members of the technical advisory committee of the War Claims Board. Campbell Scott is president of the corporation.

ELECTRICAL INTERESTS TO HOLD "GET-TOGETHER MEETING."—To obtain a closer working agreement between the electrical contractor-dealers, jobbers, central stations and manufacturers of western Pennsylvania, a "get-together meeting" will be held at the Fort Pitt Hotel, Pittsburgh, on June 23. This meeting will be held in connection with the meeting of the Pennsylvania State Association of Electrical Contractors and Dealers in Pittsburgh in the week ending June 26.

Foreign Trade Notes

THE LANCASHIRE DYNAMO & MOTOR COMPANY, LTD., Manchester, Eng., and the Crypto Electrical Company, Ltd., Willesden, Eng., have made arrangements for amalgamation of interests. It is proposed that all machines below about 10 hp. shall be manufactured at the Willesden works, and that machines above this size shall be manufactured at Manchester. The Crypto works at Willesden are being enlarged to provide for the production of approximately four times the present output of motors from about ¼ boiler hp. to 10 boiler hp. The selling organizations of the two companies have been combined throughout the British Isles. The associated firms have branch offices in London, Glasgow, Newcastle, Birmingham, Dublin, Cardiff and Bristol.

THE AMERICAN ELECTRIC MANUFACTURING COMPANY, Harrisburg, Pa., has completed negotiations for the construction of a new factory in Toronto, Ontario, Can., for the manufacture of electrical specialties. Orders have been placed for machinery and work will soon start on construction of the building.

ADDITIONAL CAPITAL NEEDED IN GERMAN ELECTRO-TECHNICAL INDUSTRY.—According to an economic report recently written regarding a large electrical industry in Germany, the average price of raw materials has increased about tenfold since 1914, owing to the increased world prices of materials and the depreciation of the mark. Before the war generator plates could be obtained for about 526 marks, but the price fixed in January, 1920, was 4,600 marks. One of the reasons why the working capital required now is larger than formerly is that the time consumed in the manufacture of articles has increased. For instance, in October, 1918, the monthly output of the electrode factory was 3,360 kilos per man; in June, 1919, it was only 1,850 kilos. The decrease in the productivity of individual workmen is partly due to the inauguration of the eight-hour day but principally to the strikes and the coal shortage. For several weeks during the past year the works were running only three days in the week.

THE WESTINGHOUSE ELECTRIC INTERNATIONAL COMPANY, East Pittsburgh, Pa., has issued, Vol. I, No. 2, for May, of its new magazine. This publication, which is printed in English, is for foreign distribution and contains engineering, semi-technical, merchandising and popular articles, together with international electrical news. Beginning with the July issue, portions of the magazine will be printed in Spanish and Portuguese.

DEVELOPMENT OF TRADE IN ELECTRICAL MACHINERY IN THE FAR EAST.—Lists of importers of and dealers in electrical machinery and apparatus in the Far East may be obtained at the Bureau of Foreign and Domestic Commerce, Washington, D. C., for the following countries by referring to the corresponding file numbers: Japan, FE-11015; China, FE-13026; Hongkong, FE-15015; Dutch East Indies, FE-19009; Burma, FE-20013; India, FE-21013; Australia, FE-23012; New Zealand, FE-24008.

TH AMERICAN CHAMBER OF COMMERCE IN FRANCE, 32 Rue Taitbout, Paris, has established a catalog file system for the benefit of French purchasers seeking American goods, where catalogs of business houses may be placed on file.

THE NORTHERN ELECTRIC COMPANY, 121 Shearer Street, Montreal, Quebec, Can., will soon start work on construction of an addition to its plant.

THE CANADIAN HART ACCUMULATOR COMPANY, St. George Street, St. Johns, Que., is planning to erect an addition to its plant and install equipment.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An industrial organization in the Caucasus (No. 32,990) desires to purchase and secure agencies for electrotechnical implements, etc.

A company in England (No. 32,964) desires to purchase generators for motor-car lighting and starting and for use in large and small vehicles and motorcycles. This firm desires to become the sole agents for these generators.

A company in Sweden (No. 33,003) is desirous of being placed in communication with steel manufacturers with a view to representing one or more firms in that country. It is especially interested in transformer plates, generator plates, etc.

DEE HENDERSON & COMPANY, 15 Maiden Lane, New York City, have received an inquiry from a native combination of financial interests in Calcutta, India, for electrical supplies and small electric lighting plants. Catalogs and prices are desired.

Trade Publications

HYDRO-ELECTRIC AND STEAM-POWER PLANTS.—Vielé, Blackwell & Buck, New York City, in bulletin No. 9, reproduce photographs of some of their engineering and construction work.

MOTORSHIP MACHINERY. — The Worthington Pump & Machinery Corporation, 115 Broadway, New York City, has issued a small pamphlet describing its engine-room equipment, including oil-engine driven generating sets for marine work.

MOTORS AND LAMPS FOR COAL MINES.—Bulletin 196 of the Bureau of Mines, entitled "Coal-Mine Fatalities in the United States, 1919," includes a list of permissible electric lamps and motors for use in coal mines.

PORT AND TERMINAL EQUIPMENT. —The Wellman-Seaver-Morgan Company, Cleveland, Ohio, has issued bulletin No. 47, describing its machinery used for loading and unloading ships, handling freight at docks, etc.

ILLUMINATION.—The Luminous Unit Company, division of the St. Louis Brass Manufacturing Company, St. Louis, has published catalog No. 7, entitled "Brascolite," covering the different types of "Brascolite" lighting fixtures, and also "Industrolite," the factory fixture, and "Aglite," all-glass fixtures, etc.

VACUUM CLEANER PARTS.—Repair parts price list No. 2 and instruction sheet have been issued by the Eureka Electric Vacuum Cleaner Company, Detroit, Mich.

DATA ON INSULATING VARNISHES. —The characteristics of insulating varnishes are explained on five loose leaf sheets published by the Sherwin-Williams Company and entitled "Efficiency Information on Sherwin-Williams Ajax Insulating Varnishes and Compounds."

HOISTING MACHINERY.—The Wellman-Seaver-Morgan Company, Cleveland, Ohio, is distributing bulletin No. 44, which describes with illustrations its hoisting and mining machinery.

GRATES.—George S. Herrick, Syracuse, N. Y., has issued a thirty-two-page booklet on Herrick shaking grates.

COMBUSTION.—The General Fuel Saving Corporation, Rochester, N. Y., is issuing a small booklet describing the use of its "Oxy-Blast" in connection with gaining complete combustion of fuel.

HYDRAULIC TURBINES.—The Wellman-Seaver-Morgan Company, Cleveland, Ohio, describes and illustrates some of its hydraulic turbines in bulletin No. 43.

TRIPLEX PUMPS.—The National Transit Pump & Machine Company, Oil City, Pa., has issued bulletin No. 302-A, in which it describes its Transit power pumps.

WALL OUTLETS. — Harvey Hubbell, Inc., Bridgeport, Conn., is circulating a sixteen-page booklet on the uses of Hubbell receptacles about the home.

PLUGS AND RECEPTACLES. — The Delta-Star Electric Company, Chicago, is distributing bulletin No. 303, describing its 100-amp., 600-volt, three-phase plugs and receptacles for extra heavy duty.

New Incorporations

THE PALISADE STORAGE BATTERY COMPANY, Englewood, N. J., has been incorporated with a capital stock of $25,000 to manufacture storage batteries. The incorporators are J. R. and B. M. Mirsh and C. W. Hadden, Yonkers, N. Y.

BEATTIE McINTYRE, LTD., Toronto, Ontario, Canada, has been incorporated by Geoffrey W. Adams, Bank of Hamilton Building; Mervil Macdonald, Edwin Smily and others. The company is capitalized at $150,000 and proposes to maufacture electrical apparatus, machinery, etc.

THE INDUSTRIAL ENGINEERING COMPANY OF CANADA, Toronto, Can., has been incorporated by Ronald G. Lee, 15 Harvard Avenue; Harry C. Bertram and others of Toronto. The company is capitalized at $20,000 and proposes to manufacture electrical equipment, tools, etc.

BASTIAN-MORLEY, LTD., Toronto, Can., has been chartered with a capital stock of $300,000 to manufacture stoves, heaters, lighting and heating systems, etc. The incorporators are James P. Morley, Oliver A. Ludlow, Laporte, Ind.; John M. Godfrey, Toronto, and others.

THE ELECTRO MEDICAL APPLIANCE COMPANY, Toronto, Can., has been chartered with a capital stock of $50,000 by George F. Davis, 24 Toronto Street; William J. Herdman, 216 Seaton Street, Arthur J. Layzell and others.

ELECTRO LIFE CHEMICALS COMPANY, Brooklyn, N. Y., has been incorporated with a capital stock of $15,000 to manufacture hospital supplies. The incorporators are F. C. and J. A. Hecker and R. Rodrian, 229 East Nineteenth Street, Brooklyn.

THE WOODCOCK-VANDY ELECTRIC CORPORATION, Rochester, N. Y., has been incorporated with a capital stock of $15,000 by W. C. Woodcock, C. B. Vandy and G. W. Lockman.

THE UNION ELECTRIC MOTOR COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $200,000. The incorporators are F. R. Hinsell, J. Vernon Pimm and D. M. McFarland of Philadelphia, Pa.

THE DENGLER, LIDDY, BURD ELECTRICAL COMPANY, 207 Broad Street, Elizabeth, N. J., has been incorporated by Edward J. Dengler, Thomas A. Liddy and Frank R. Burd. The company is capitalized at $100,000 and proposes to manufacture electrical specialties.

THE TOMPKINSVILLE (KY.) LIGHT COMPANY has been incorporated with a capital stock of $5,000 by Ernest H. Herbert, C. Smith and Otto L. Smith.

THE CLAIBORNE COUNTY LIGHT & POWER COMPANY, Tazewell, Tenn., has been organized with a capital stock of $25,000 to erect an electric transmission line to connect at Cumberland Gap with the system of the Kentucky Utilities Company, Louisville, Ky. J. P. Ritchie, New Tazewell, is president.

THE WINONA (MINN.) ELECTRIC CONSTRUCTION COMPANY has been incorporated with a capital stock of $50,000 by Melvin C. Berrum and others.

THE SOLRAY ELECTRIC COMPANY, Fargo, N. D., has been incorporated with a capital stock of $25,000 by F. B. Messing and others.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

DOVER, N. H.—The Twin State Gas & Electric Company has recently taken over the property of the Cloutman Gas & Electric Company at Farmington and will extend its transmission line to supply electricity there and will also extend its service to Alton. Contract, it is understood, has been placed by the company for a new turbine for its power station on Cocheco Street, which will nearly double the output of the plant.

EAST BRIDGEWATER, MASS. — The Edison Electric Illuminating Company of Brockton has petitioned the Department of Public Utilities for authority to acquire lands and right-of-way for the erection of a transmission line from East Bridgewater to Stoughton, a distance of about 10 miles, to cost approximately $83,000, of which $24,000 would be for right-of-way and lands.

EVERETT, MASS.—The Malden Electric Company of Malden contemplates the erection of a local substation. Equipment includes step-down transformers and switchboard apparatus. The total cost is estimated at about $65,000.

MEDFORD, MASS.—Work will soon be started on the construction of a local substation by the Malden Electric Company of Malden, to cost about $65,000, including equipment. Charles Tenney, 201 Devonshire Street, Boston, is engineer.

SALEM, MASS. — The Salem Electric Light Company contemplates the erection of an addition to its existing power plant and the installation of equipment, to cost about $650,000. Charles Tenney, 201 Devonshire Street, Boston, is engineer.

BRISTOL, CONN.—The City Council is considering the erection of a central fire station and the installation of an alarm system.

HARTFORD, CONN.—Plans filed for the Hartford Rubber Company, a subsidiary of the United States Rubber Company, Broadway and Fifty-eighth Street, New York, N. Y., for the construction of a new plant include the erection of an electric power plant, to cost about $260,000.

NEW BRITAIN, CONN.—Contract has been awarded by the American Hardware Corporation to the William H. Allen Company, Hungerford Place, for the construction of a new transformer house at its plant.

WATERBURY, CONN.—The installation of a fire-alarm system is under consideration by the City Council.

WATERBURY, CONN.—The Connecticut Light & Power Company, 111 West Main Street, has awarded contract to D. Wooster, 39 Harvard Street, for the erection of a two-story addition to its power station, to cost about $10,000.

Middle Atlantic States

BROOKLYN, N. Y.—The Brooklyn Edison Company has had plans prepared for the construction of a power house on Washington Avenue, to cost about $40,000.

BUFFALO, N. Y.—The Buffalo General Electric Company has had plans prepared for the construction to a power station at Babcock and Hannah Streets, to cost about $25,000.

BUFFALO, N. Y.—Frank C. Perkins, Commissioner of Public Affairs, has introduced an ordinance in the City Council for the purpose of compelling railroads entering Buffalo to electrify their systems. The project would cost the railroads about $80,000,000. Commissioner Perkins has also recommended to the Council that Corporation Counsel Rann be instructed to draft a bill which would enable the city to build a power plant at Niagara Falls with a distribution system and transmission lines.

DUNKIRK, N. Y.—Application has been made by the Niagara & Erie Power Company, Marine Bank Building, Buffalo, for permission to construct an addition to its power plant and extend its electric distribution system at Dunkirk.

GRAND ISLAND, N. Y.—The Tonawanda Power Company has applied to the Public Service Commission for permission to erect an addition to its Grand Island power plant.

LE ROY, N. Y.—Extensions to the ornamental street-lighting system are under consideration.

NEW YORK, N. Y. — The American Traction & Light Company, 120 Broadway, has arranged for a note issue of $6,000,000, part of the proceeds to be used for extensions and betterments to its properties at Milwaukee and Madison, Wis., St. Paul, Minn., San Antonio, Tex., and other districts.

BOONTON, N. J.—The Boonton Electric Company has been granted franchise to extend its electric distribution system to the Jacksonville and Lincoln Park sections.

CASSADAGA, N. Y.—Lyman P. Hapgood, superintendent of the department of water and lighting, is planning to install at the Cassadaga station three 150-hp. water-tube boilers with equipment, two steam-driven centrifugal pumps, two steam-driven air compressors, compound two-stage, capable of delivering sufficient air under 80 lb. pressure to equal 160-hp. pumping engines; two motor-driven centrifugal pumps not to exceed 1,200 r.p.m., 440-volt, three-phase, 60-cycle, and equipment; two direct-connected steam-turbine generators to generate current at 440 volts, three-phase, 60-cycle, capacity 378 kw., turbine capacity 540 hp.; two motor-driven, two-stage air compressors sufficient to furnish air at 80 lb. pressure to produce 160 hp.

CAMDEN, N. J.—The installation of a new street-lighting system on Hadden Avenue, Westmont, is contemplated by the town committee.

ESSEX FELLS, N. J. — The Borough Council is considering the purchase of a local electric lighting plant for establishment as a municipal plant. The plant has been offered by the Essex Fells Electric Light & Power Company for $175,000.

NEWARK, N. J. — The Schofield Oil Company, Avenue R, has awarded contract to E. M. Waldron Company, Firemen's Building, for the erection of a power house, to cost about $30,000.

BLOSSBURG, PA. — Plans have been completed by the Board of Managers for the construction of a power house and laundry building at the Blossburg Hospital, to cost about $20,000.

CHESTER, PA.—The Chester Steel Casting Company plans to rebuild the power house at its local plant, which was recently destroyed by fire, causing a loss of $50,000.

ELWOOD CITY, PA.—The American Steel Company, Park Building, Pittsburgh, has awarded a general contract to the Duquesne Construction Company, Bessemer Building, Pittsburgh, for the erection of a power house, 38 ft. x 60 ft. M. B. Kelly is president.

NANTICOKE, PA. — Work has been started on the construction of a power plant for the Delaware, Lackawanna & Western Railroad of Scranton, to cost about $75,000.

PHILADELPHIA, PA.—The Enterprise Manufacturing Company, Third and Dauphin Streets, has had plans prepared for the construction of a new power house at its hardware plant on Bodine Street, to cost about $28,000.

PHILADELPHIA, PA. — Contract has been awarded to W. D. Lukins, 432 West Walnut Street, North Wales, Pa., by the L. H. Gilmer Company, Cottman and Keystone Streets, Philadelphia, for the erection of a power house and a warehouse, to cost about $200,000.

PHILADELPHIA, PA.—Plans have been prepared for the erection of an addition to the power plant of the Hale Kilbourne Corporation, Eighteenth and Lehigh Streets, to cost about $60,000.

SPANGLER, PA.—The Penn Central Light & Power Company of Altoona is having plans prepared for the erection of a transformer station. Day & Zimmerman, Inc., 611 Chestnut Street, Philadelphia, are engineers.

BALTIMORE, MD.—Bids will be received by the Delinn Tire Company until July 1 for the construction of a factory, office and power plant, to cost about $150,000. N. C. Price, president, 131 Mount Royal Avenue, is in charge.

HAGERSTOWN, MD. — The report on the estimated cost of extension to the "white way" street-lighting system, submitted by City Light Supervisor Grubmyer, shows that the probable expenditure would be about $18,000.

PETERSBURG, VA. — The Chesterfield Manufacturing Company contemplates the erection of a power plant on Swift Creek. William C. Whitney, Virginia Railway & Power Building, Richmond, is engineer.

MILLVILLE, W. VA.—The Hagerstown & Frederick Railway Company of Hagerstown contemplates the erection of an electric transmission line from Millville to Winchester. M. A. Pooler is general manager.

WASHINGTON, D. C.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., has had plans prepared for the erection of a power plant at Ohio River Dam No. 48, near Cypress, Ind., to cost about $45,000. Col. G. M. Hoffman, Post Office Building, Louisville, Ky., is in charge.

WASHINGTON, D. C.—Bids will be received by the Commissioners of the District of Columbia, 509 District Building, Washington, D. C., until July 5, for electric generating set, exciter, switchboard and accessories for central power plant at the District of Columbia institutions, Lorton, Va. Plans and specifications may be obtained from the purchasing officer, 320 District Building.

WASHINGTON, D. C.—Bids are being received by the construction officer, Walter Reed Hospital, for improvements to the power plant at the institution.

North Central States

BATTLE CREEK, MICH.—The erection of a new power plant at the Battle Creek Sanitarium, to cost about $50,000, is contemplated.

ST. JOSEPH, MICH.—Plans have been prepared by the General Electric Company for a curb street-lighting system for the business section of St. Joseph.

AKRON, OHIO.—The substation of the Northern Ohio Traction & Light Company at Thompson's Corners was recently destroyed by fire, causing a loss of about $50,000.

COLUMBUS, OHIO.—The erection of a two-story factory, 140 ft. x 190 ft., and a power plant is contemplated by the Climax Rubber Company, Citizens' Bank Building.

McARTHUR, OHIO.—Franchise has been granted to the McArthur Light & Power Company to furnish light for the streets.

MIDDLETOWN, OHIO.—The Colin Gardner Paper Company has awarded contract to the Ferro Concrete Construction Company, Richmond and Harriet Streets, Cincinnati, for the erection of a turbine power plant, to cost about $45,000.

TOLEDO, OHIO.—Contract will soon be awarded for the construction of a pumping station, 116 ft. x 39 ft. Equipment, including switchboard, electric crane, four 300-hp. motors, one 200-hp. motor, two vacuum pumps, five centrifugal pumps, etc., will be required. Fuller & McClintock, Broadway, New York, N. Y., are engineers and architects.

ANDERSON, IND.—Plans are under way for additions to the municipal electric light and power plant, to cost about $300,000. C. Brossman, 1503 Merchants' Bank Building, Indianapolis, is engineer.

GOSHEN, IND.—The city officials plan to operate the water plant by electricity to be purchased from the Hawks Electric Company.

TELL CITY, IND.—Petition has been made for permission to distribute electric current from the municipal plant to persons outside of the city.

WILLIAMS, IND. — The Southern Indiana Power Company contemplates the erection of a 60,000-volt transmission line from its central plant at Williams to Edwardsville. W. E. Murchie is manager.

GALESBURG, ILL.—The installation of electric lights in Lincoln Park is contemplated. Frank Connelly is city engineer.

ELROY, WIS.—The city officials are considering the purchase of electric power from Reedsburg or Maustin, and the erection of a transmission line from Reedsburg is also contemplated. J. W. Cadby, Washington Building, Madison, is engineer.

HALLOCK, MINN.—Bids will be received by F. J. Wickie, village clerk, Hallock, Minn., until June 28, for labor and materials required for electric power equipment to be erected at the present power station. Plans and specifications are on file in the office of the village clerk and in the office of Earl D. Jackson, consulting engineer, St. Paul, Minn.

KENNEDY, MINN.—Bids will be received by C. N. Fowler, village clerk, until June 28, for labor and materials required for the construction of an electric distribution system for the village of Kennedy. Plans and specifications are on file in the office of the village clerk and in the office of Earl D. Jackson, consulting engineer, St. Paul, Minn.

HARTLEY, IOWA.—The construction of an electric power plant is under consideration by the city officials. H. T. Broders is city clerk.

MILBANK, S. D.—Bids will be received by the City Council until June 26 for the construction of an ornamental street-lighting system to include approximately 3,300 lineal feet of No. 8 duplex conductor cable, thirty-one ornamental lamp posts and one-pole-type constant-current transformer with automatic time switch. Plans and specifications may be seen and blank proposals may be obtained at the office of A. A. Blomquist, city auditor.

LA CYGNE, KAN.—Bids will be received by M. S. Bunch, city clerk, until June 25 for furnishing materials and labor required for improvements to the municipal waterworks plant, to include the installation of two 200-g.p.m., 50-ft.-head, horizontal-motor-driven centrifugal pumps; one 75-kw. steam generating unit, including simple slide-valve engine, three-phase, 60-cycle, 2,300-volt generator exciter and switchboard panel; one 500-g.p.m. compound duplex, non-condensing double-acting plunger-type pumping engine, etc.

Southern States

KINSTON, N. C.—Work has been started on the construction of two dormitories, a power plant and minor buildings at the Caswell Training School, to cost about $300,000. Dr. C. Banks McNairy is superintendent.

UNION, S. C.—At an election to be held on June 22 a proposal to issue $30,000 in bonds for improvements and extensions to the municipal electric light system will be submitted to the voters.

CLARKSVILLE, TENN.—The Kentucky Public Service Corporation, Bowling Green, Ky., contemplates the erection of a local electric generating station. A. D. Couch, Ithaca, N. Y., is engineer.

COPPERHILL, TENN.—The Tennessee Copper Company, 61 Broadway, New York, N. Y., is having plans prepared for the complete electrification of its local plant.

ISABELLA, TENN.—The Ducktown Sulphur, Copper & Iron Company will soon use 2,000 kw. in addition to power it now purchases.

BALDWYN, MISS.—Bonds to the amount of $5,000 have been voted for improvements to the electric light and water systems.

CLAREMORE, OKLA.—Plans are being prepared for extensions and improvements to the municipal electric light and power systems, including the installation of machinery and equipment consisting of rotating field alternator, exciter, switchboard and cables, pumping units, etc.

SAN ANGELO, TEX.—E. L. Wells, city manager, has been instructed by the City Commission to secure estimates covering probable cost of the installation of a municipal lighting plant. It is proposed to submit a bond issue of $500,000.

Pacific and Mountain States

KLAMATH FALLS, ORE.—An estimate regarding cost of installation, running expense, etc., of the establishment of a public-owned light and power plant for the Main Street section has been submitted.

RIVERSIDE, CAL.—The Southern Sierras Power Company is having plans prepared for the construction of an addition to its local power plant, to cost about $50,000.

SAN FRANCISCO, CAL. — The Great Western Power Company has been authorized to issue $1,500,000 preferred stock to complete the Caribou hydro-electric plant on the Feather River. It was originally estimated that the cost of the development would be $4,321,430, but plans have been revised and the cost is now estimated at $6,246,100.

CEDAR CITY, UTAH.—Bonds to the amount of $15,000 have been voted for the installation of an electric street-lighting system.

RICHFIELD, UTAH.—The installation of an ornamental street-lighting system, requiring thirty-six large standards and 6,500 ft. of parkway cable, is contemplated. Elizabeth Hansen is city recorder.

HAILEY, IDAHO.—Estimates are being made by B. Green of the Green Construction Company, Salt Lake City, Utah, on the construction of a hydro-electric plant on the east fork of the Wood River to furnish power for the Mascot Mine and Mill, 5 miles north of the plant.

LAS VEGAS, N. M.—Improvements to the street-lighting system are contemplated.

Canada

ESQUIMAULT, B. C.—Bids will soon be received by the Department of Public Works of the Dominion of Canada for the construction of a drydock to cost about $1,500,000. Considerable electrical equipment will be required. R. C. Desrochers, Ottawa, Que., is secretary of the department.

THORNBURY, ONT.—Work will soon be started on the construction of an electric lighting plant by the Thornbury Electric Lighting Company, to cost about $15,000. Harry Pedwell is chairman.

TORONTO, ONT. — The Teskaming & Northern Ontario Railway commission contemplates the following work this year: Renewing telegraph and telephone pole; line equipment and stringing circuit from Matheson to Porguis Junction, estimated cost $5,000; additional telephone circuits between North Bay and New Liskeard, $20,000; five metallic telephone circuits between Swastika and Kirkland Lake, $2,500; erecting telephone line from Cobalt to Porguis Junction, $25,800, etc. S. B. Clement, North Bay, Ont., is chief engineer.

MONTREAL, QUE.—The Montreal Light, Heat & Power Company, 83 Craig Street, West, has awarded contract to John Quinlan & Company, Green Avenue, Westmount, Que., for the erection of a power house, to cost about $22,000.

(Issued May 18, 1920.)

14,861 (reissue). MOTOR-CONTROL SYSTEM; Reuben I. Wright, Wickliffe-on-the-Lake, Ohio. App. filed Aug. 6, 1918. For two or more mechanically connected to same load.

14,863 (reissue). CODE-RINGING TELEPHONE SYSTEM; Talbot G. Martin, Chicago, Ill. App. filed Oct. 24, 1916. Applying code ringing to local battery line.

1,338,987. SYSTEM OF ELECTRICAL GENERATION AND CONTROL; Charles F. Kettering, Dayton, Ohio. App. filed Dec. 18, 1916. Prevents operation of electric machine as a motor when lubricant supply of engine reaches low point.

1,340,170. METHOD OF JOINING METALS BY ELECTRIC WELDING; Charles H. Kicklighter, Macon, Ga. App. filed Oct. 27, 1919. Welding by electric current and pressure.

1,340,636. STORAGE BATTERY; Norman D. Sturges, Bellerose, Queens, N. Y. App. filed Feb. 27, 1920. Celluloid binder for storage battery.

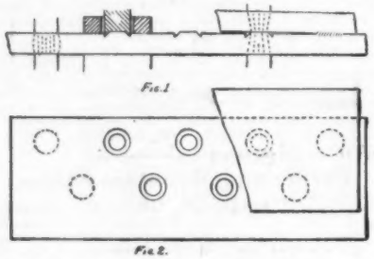


Fig. 1

Fig. 2.

1,340,170. Method of Joining Metals by Electric Welding

1,340,637. STORAGE BATTERY; Norman D. Sturges, Bellerose, Queens, N. Y. App. filed Feb. 27, 1920. Glass jar with walls of uniform thickness.

1,340,644. REINFORCED WELDED JOINT; David H. Wilson, Ridgewood Park, N. J. App. filed Sept. 14, 1918. For uniting cast iron or other metals together.

1,340,665. AUTOMATIC ELECTRIC SWITCH FOR ELECTRIC FLUID HEATERS; Antonio Papini, Philadelphia, Pa. App. filed June 12, 1919. Automatic switch for fluid heater.

1,340,678. REGULATOR FOR ELECTRIC MOTORS; George H. Whittingham, Bancroft Park, Md. App. filed Oct. 23, 1917. Controls speed of shunt-wound motors.

1,340,698. ELECTROMAGNETIC DEVICE; C. W. Burrows, Washington, D. C. App. filed April 27, 1917. Electromagnet with adjustable pivoted armature.

1,340,716. ELECTRIC CIGAR LIGHTER; Reginald J. H. Hill, London, England. App. filed Sept. 16, 1919. Has renewable tip.

1,340,736. ELECTRIC SOLDERING; Harold K. Parsons and Harry H. Styll, Southbridge, Mass. App. filed Sept. 30, 1919. Automatically regulates temperature and amount of deposit.

1,340,795. ELECTRIC LIGHT REGULATOR; Louis Sawyer-Soucy and Albert G. Sawyer-Soucy, Lynn, Mass. App. filed Feb. 25, 1920. Variable resistance in socket.

1,340,807. TELEPHONE RECEIVER; Augustus Umholtz, Port Carbon, Pa. App. filed April 7, 1919. Air vents allow holding close to ear.

1,340,813. PROCESS OF MANUFACTURING INSULATORS; Pierre J. H. Bernard, Montreal, Quebec, Canada. App. filed Dec. 27, 1919. Mica and asbestos insulators for heaters.

1,340,826. ELECTROLYTIC PROCESS; William E. Greenwalt, Denver, Col. App. filed Feb. 24, 1914. For obtaining metals from impure salts.

1,340,839. FLEXIBLE CORD; William L. Runzel, Chicago, Ill. App. filed May 19, 1917. Switchboard cord with concentric conductors.

1,340,856. ATTACHMENT PLUG; Gilbert W. Goodbridge, Bridgeport, Conn. App. filed Dec. 31, 1917. For "Edi-Swan" sockets.

(Issued May 25, 1920.)

1,340,908. DENTAL ENGINE; Oscar H. Pieper and Alphonse F. Pieper, Rochester, N. Y. App. filed May 27, 1912. Has counterbalanced motor.

Record of Electrical Patents

Notes on United States Patents

1,340,918. SWITCHING APPARATUS; William M. Scott, Tredyffrin Township, Chester County, Pa. App. filed Nov. 26, 1919. Motor-operated circuit breakers.

1,340,933. ELECTRICAL TESTING SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed July 26, 1917. For automatic telephone.

1,340,934. AUTOMATIC TELEPHONE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Dec. 1, 1917. Systems employing machine switching.

1,340,936. TESTING SYSTEM; Roy D. Conway, Chatham, N. J. App. filed May 9, 1918. Testing marginal relays.

1,340,940. TELEPHONE-EXCHANGE SYSTEM; Amos F. Dixon and Frank N. Reeves, Newark, N. J. App. filed May 7, 1917. Device at first operator's position exhibits number of line at second operator's position.

1,340,942. SIGNALING SYSTEM; George D. Edwards, East Orange, N. J. App. filed Nov. 28, 1917. Elimination of telegraphic impulses from telephonic circuit.

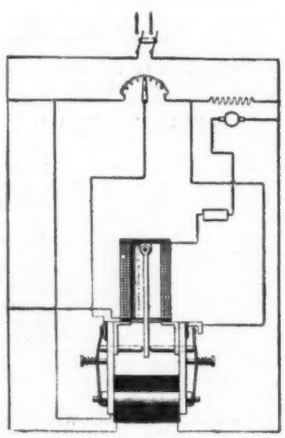
1,340,951. SMELTING TIN AND OTHER ORES; James H. Gray, New York, N. Y. App. filed March 18, 1919. Resistor furnace.

1,340,955. TELEPHONE SET; Raymond R. Herrmann, New York, N. Y. App. filed March 25, 1918. One-piece hand set.

1,340,963. RESONANT CONVERTER; Walter S. Lemmon, New York, N. Y. App. filed Sept. 1, 1916. For production of oscillations in radio-signaling systems.

1,340,979. CALL-DISTRIBUTING SYSTEM; Lipa Polinkowsky, Hyde Park, London, England. App. filed July 16, 1918. For semi-automatic telephone switching.

1,340,982. TELEPHONE SYSTEM; John N. Reynolds, Greenwich, Conn. App. filed Dec. 29, 1916. For automatic exchange.



1,340,678. Regulator for Electric Motors

1,340,997. MACHINE-SWITCHING TELEPHONE SYSTEM; Samuel B. Williams, Jr., Brooklyn, N. Y. App. filed Oct. 10, 1917. Moving switch hook does not affect operation.

1,341,006. IONIZED-CHAMBER DEVICE; Clifford D. Bagcock, New York, N. Y. App. filed Oct. 11, 1916. Parts secured before inclosing.

1,341,007. TELEPHONE SET; William T. Booth, East Orange, N. J. App. filed June 30, 1917. Vestibule telephone.

1,341,054. PLURAL SOCKET; David D. Gordon, Chicago, Ill. App. filed Aug. 25, 1917. Plurality of plugs fit in one socket.

1,341,105. TELEPHONE; Ernest A. Bohlman, Chicago, Ill. App. filed May 25, 1918. Supporting bracket for telephone.

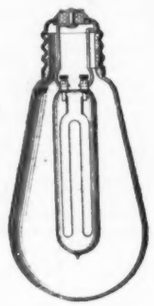
1,341,232. WIRELESS TRANSMISSION OF SPEECH; Earl C. Hanson, Washington, D. C. App. filed June 18, 1917. Wireless telephone.

1,341,280. TELEPHONE HAND SET OR HAND PIECE; Herman G. Pape, New York, N. Y. App. filed June 24, 1918. One-piece hand micro-telephones.

1,341,282. MAGNETO FOR IRREGULAR IGNITION; Leon W. Rosenthal, New York, N. Y. App. filed Oct. 2, 1918. For internal-combustion engines.

1,341,284. SAFETY TROLLEY FINDER; Harry B. Sawyer, Ogden, Utah. App. filed July 20, 1917. Guides swing in position when trolley is off.

1,341,293. ELECTRIC WELDING DEVICE; William P. Bovard, Mansfield, Ohio. App. filed Oct. 24, 1919. Current controlled at electrode.



1,341,581. Electric Incandescent Lamp

1,341,311. MODULATION OF HIGH-FREQUENCY CURRENTS; Raymond A. Heising, East Orange, N. J. App. filed Aug. 25, 1915. For wireless telegraphy or telephony.

1,341,327. SYSTEM OF ELECTRICAL GENERATION; Charles F. Kettering and William A. Chryst, Dayton, Ohio. App. filed Oct. 27, 1915. Farm-lighting plant.

1,341,336. CONDENSER AND METHOD OF MAKING SAME; Byron MacPherson, Roxbury, Mass. App. filed Nov. 19, 1919. Mica condenser for high potentials.

1,341,337. METHOD OF UNITING DISSIMILAR METALS; George A. Mead, Mansfield, Ohio. App. filed Jan. 8, 1920. Bonding track rails by electric welding.

1,341,339. ELECTRICAL CONNECTOR; John R. Pattee, New York, N. Y. App. filed May 21, 1917. Spring-clip lamp socket.

1,341,340. MAGNETO-ELECTRIC TRANSFORMER; Parnell Rabbidge, Neutral Bay, New South Wales, Australia. App. filed Dec. 24, 1919. Changes direct-current voltage.

1,341,348. SPARK-GAP DEVICE; Richard F. Van Meter, Minneapolis, Minn. App. filed May 26, 1919. To intensify spark-plug fire.

1,341,358. ACOUSTIC STAND FOR TELEPHONE RECEIVERS; Byron E. Chapin, Oklahoma, Okla. App. filed Aug. 26, 1918. Eliminates necessity for holding receiver directly against head.

1,341,362. IGNITION DEVICE; Leo Ranney, John W. Dissette and Franklin E. Tyrrell, Washington, D. C. App. filed June 10, 1919. For spark plugs.

1,341,468. SEPARABLE ATTACHMENT PLUG; John J. Kenney, Pittsburgh, Pa. App. filed July 23, 1915. Body and cap positively locked.

1,341,469. SECONDARY OR STORAGE MULTIVOLT BATTERY; William E. Kershaw, Philadelphia, Pa. App. filed Aug. 23, 1918. Durable storage battery.

1,341,471. PORTABLE ELECTRIC HAND LANTERN; James W. Knoblock, Elmira, N. Y. App. filed June 19, 1917. With storage battery.

1,341,473. MACHINE-SWITCHING TELEPHONE SYSTEM; Alben E. Lundell, New York, N. Y. App. filed March 25, 1918. Operates stepping magnets.

1,341,581. ELECTRIC INCANDESCENT LAMP; Frank W. Peterson, Peoria, Ill. App. filed Feb. 4, 1919. Filament in removable inner globe.